CHAPTER V AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Chapter V

Affected Environment and Environmental Consequences

INTRODUCTION

This chapter describes the existing physical and biological resources and environmental factors in the study area (affected environment) and the effects of the alternatives on certain resources and environmental factors (environmental consequences). Resources include soils, groundwater, vegetation, wildlife, special status species, recreation and visual resources, cultural resources, Indian sacred sites, and Indian trust assets. Environmental factors include climate, air quality, noise, topography, geology, land use, transportation, economics, and environmental justice. All resources and factors within the study area are described in the affected environment section; however, only those resources and factors that could be affected by the alternatives are analyzed in the environmental consequences section.

The No Action Alternative, which provides the basis of comparison for the effects of the three action alternatives, describes conditions in the future if no action were implemented.

The analysis of the potential effects of the alternatives on resources is based on the professional judgment and experience of Bureau of Reclamation (Reclamation) staff specialists, their discussions with other experts and professionals, literature review, and field trips to the study area. The depth of the analyses corresponds to the scope and magnitude of the potential effects of the alternatives. If an alternative could adversely affect a resource, appropriate mitigation measures are presented.

The goal of this chapter is to quantify, to the extent possible, the effects of each alternative on the resources and environmental factors. However, if quantitative estimates were not possible, qualitative estimates are provided.

CLIMATE

The 5-mile zone study area is within the Yuma Desert, a sub-region of the Sonoran Desert, which is one of the hottest, driest regions on the North American continent. **Photograph V-1** shows a typical landscape.

Photograph V-1.—Typical landscape within 5-mile zone area.

According to National Weather Service records, temperatures average at least 100 degrees Fahrenheit (°F) from June 4 to September 24. The warm temperatures ensure a year-round growing season, with an average of 348 frost-free days a year, which allows three harvests a year.

The area receives an average of 2.77 inches of precipitation a year and averages only 17 rainy days a year. Consequently, the area has no reliable source of surface water other than the Colorado River.

Average wind speeds are less than 8 miles per hour, although the Federal Aviation Administration cautions pilots in the area to be aware of blowing sand. Predominant winds are from the south during the summer (June through mid-September), and from the north during the winter (November through February).

Because of the hot climate, the U.S. Border Patrol (Border Patrol) stationed in Yuma, Arizona, often works at night during the spring, summer, and fall months, rescuing or pursuing possible illegal immigrants in off-road vehicles rather than on foot. This use of off-road vehicles has resulted in a maze of two-track trails throughout the 5-mile zone.

AIR QUALITY

Affected Environment

To assess air quality in the 5-mile zone study area, Reclamation reviewed two recent environmental assessments and one project study with information about the area's air quality. The environmental assessments addressed the commercial port-of-entry and

the Area Service Highway (ASH) projects. The project study was an environmental evaluation associated with the development of a master plan for the proposed expansion of the local airport, Rolle Airfield.

Review of these studies and a search of the Arizona Department of Environmental Quality (ADEQ) website (www.adeq.state.az.us) documents that the 5-mile zone is within the Yuma PM_{10} Non-Attainment Area. (PM_{10} is defined as particulate matter with an aerodynamic diameter of less than or equal to 10 micrometers. The purpose of the PM_{10} standard is to protect human health from particulate matter that is respirable and, thus, detrimental to lung tissue.) The Environmental Protection Agency (EPA) designates areas with air quality that does not meet standards as "non-attainment areas." Once an area has been designated as a non-attainment area, a State Implementation Plan (SIP) must be developed. The SIP is a document that demonstrates to the EPA measures that will be taken to reduce the pollutant levels to meet air quality standards. The original Yuma PM_{10} SIP was completed and submitted to the EPA in November 1991. It was revised in July 1994 and currently is awaiting EPA review and approval. However, it has been deemed adequate to meet or exceed the requirements for completion of such plans.

Natural and manmade activities, such as operating a vehicle on unpaved roads, agricultural tilling, open burning, pollination, and wind blown dust emit particulates. The Yuma PM_{10} SIP indicates that the two main sources of particulate pollution within the study area are agricultural tilling and unpaved roads, which account for nearly 75 percent of the total regional PM_{10} emissions. Most of the remaining 25 percent of particulate pollution comes from agricultural burning, windblown agricultural lands, and unpaved parking areas.

According to ADEQ, Yuma County last exceeded the 24-hour standard for PM_{10} in 1991, with a particulate level of 229 micrograms per cubic meter, and last violated the annual arithmetic mean in 1990, with a particulate level of 57 micrograms per cubic meter. According to recent ambient monitoring data, the Yuma area has met the 24-hour and annual PM_{10} standards for the past several years. Yuma County and associated areas within the study area have not exceeded air quality standards for other pollutants identified and monitored by ADEQ and EPA, including ozone, carbon monoxide, sulfur dioxide, and lead.

Preparers of the Rolle Airfield airport master plan contacted the ADEQ, Office of Air Quality, to determine the potential effects of proposed airport development on air quality. ADEQ verified that the airfield is within the Yuma air quality non-attainment area. Regarding airport development, ADEQ stated, "Air quality permits may be required during construction. Design review of all improvements should focus on application of Best Management Practices to reduce particulates. Extra paving, gravel mulches, and vegetation are examples of Best Management Practices that could be employed to minimize air quality problems attributable to the facility." ADEQ's response would apply to any development or ground disturbing activity conducted within the 5-mile zone study area and reflects air pollution reduction measures identified in the Yuma PM_{10} SIP.

Environmental Consequences

Alternative A

Existing air quality and potential effects on air quality would continue under Alternative A.

Alternative B

Alternative B would provide the maximum benefits to air quality within the study area among all the alternatives, primarily because it allows less land clearing and emphasizes closing and rehabilitating un-needed roads and OHV roads/trails. Currently, dust caused by vehicles on dirt roads and blowing dust on cleared lands are some of the most common causes of airborne particulate pollution in the study area. Also, limited public use and access (compared to the other alternatives) throughout the study would result in less air quality degradation from vehicle emissions. In addition, less commercial development would mean fewer diesel truck emissions and industrial airborne pollutants.

Alternative C

Alternative C would result in the greatest potential adverse effects of air quality among all the alternatives. Maximizing recreation, community, and commercial development within the study area would result in more unsurfaced roads and parking areas, cleared land (and, thus, more vehicle-caused dust and blowing dust), and vehicle and industrial airborne emissions than under Alternatives B and D.

Alternative D

Alternative D would provide for less construction of unsurfaced roads for recreational access and community and commercial development than Alternative C but more than for Alternative B. Therefore, vehicle-caused dust, blowing dust, and vehicle and industrial airborne emissions would be greater than under Alternative C but less than under Alternative B.

Cumulative Impacts

Construction of new roads and the resulting increase in public use and vehicle emissions and airborne dust within the study area, as well as the surrounding area, could have a cumulative adverse effect on air quality.

Mitigation

Paving or surfacing primary and secondary roads and parking areas to prevent dust will help reduce airborne particulates throughout the study area. Additionally, requiring

dust abatement measures during construction activities and revegetating disturbed areas, including areas disturbed by OHV use, areas will reduce airborne particulates.

Residual Impacts

No residual impacts have been identified.

NOISE

Affected Environment

Most areas within the 5-mile zone study area are rural and undeveloped, interspersed with several relatively isolated land uses and agricultural groves. Land uses generally found within or adjacent to the study area, such as agricultural tilling and sludge disposal, generate relatively low levels of noise. The wells and pumping substations within the 5-mile zone study area are also generally quiet and generate low levels of noise while in operation. Vehicular traffic along 23rd Street creates a moderate level of noise audible near the highway. Mexican Federal Highway 2, located along the international boundary, generates low levels of noise audible within portions of the 5-mile zone study area. Agricultural operations within and adjacent to the 5-mile zone study area create seasonal noise from agricultural equipment and truck operations.

The recent Rolle Airfield airport master plan described the effect of a proposed expansion of airfield operations on the surrounding area. The plan concluded that even by the year 2020, the anticipated noise level should not unduly affect any existing or proposed land uses surrounding the airfield.

The Arizona Department of Transportation (ADOT) conducted a study of the noise environment adjacent to the proposed ASH, in accordance with Title 23 Code of Federal Regulations (CFR), Part 772, U.S. Department of Transportation, FHWA Procedures for Abatement of Highway Traffic Noise and Construction Noise, and the 2000 Arizona Department of Transportation Noise Abatement Policy. The ADOT study concluded that the major noise effects associated with the ASH would be in areas outside the 5-mile zone and that for areas adjacent to the proposed ASH within the 5-mile zone, noise effects would not be substantial or require any noise abatement measures.

Environmental Consequences

Alternative A

Under Alternative A, no additional restrictions would be placed on motorized recreation users. Therefore, noise resulting from off-highway vehicle (OHV) use likely would affect the feeling of solitude and natural ambience for those users seeking immersion in the natural, desert environment.

The adverse effects of noise resulting from new developments and increased vehicle use of new roads would be greater than under Alternative B but less than under Alternatives C and D because Alternatives C and D provide for construction of more secondary roads. The effects of noise from secondary roads likely would affect the feeling of solitude and natural ambience for those users seeking immersion in the natural, desert environment.

The effects of noise from Rolle Airfield would be the same under all alternatives.

Alternative B

Noise levels would decrease under Alternative B primarily because recreational OHV use would be eliminated and less development would be allowed.

Alternative C

The adverse effects of noise would be the greatest under Alternative C, primarily because Alternative C provides for the greatest construction of secondary roads to access campgrounds, day use facilities, and trailheads. These roads could create noise impacts within a greater portion of the study area than the other action alternatives. The construction and use of additional primary roads to access recreation, community, and commercial developments also would increase the adverse effects of noise.

Recreation, community, and commercial development would be greatest among all the alternatives, thereby creating additional noise and potentially affecting the solitude and naturalness of the area.

Alternative D

The adverse effects of noise under Alternative D would be greater than under Alternative B but less than under Alternative C. Unlike Alternative B, Alternative D provides for construction and use of secondary roads to access campgrounds, day use facilities, and trailheads. Construction and maintenance of primary roads would be the same as under Alternative B.

Limited recreation, community, and commercial development also would create additional noise, potentially affecting the solitude and naturalness of the area, although eliminating recreational OHV use may mitigate some adverse effects of noise caused by development.

Cumulative Impacts

Increased recreation, community and commercial development, as well as other development (such as the ASH and new commercial port-of-entry), and the associated increased use of secondary roads may have a cumulative adverse effect on noise within the entire study area.

Mitigation

No mitigation has been identified.

Residual Impacts

No residual impacts have been identified.

TOPOGRAPHY

The topography of the 5-mile zone is relatively flat, sloping gently from an altitude of approximately 135 feet above sea level on the far western boundary to about 275 feet above sea level at the far northeastern corner. However, most of the 5-mile zone is about 150 to 200 feet above sea level and is punctuated by numerous small basins, particularly in the eastern half (U.S. Geological Survey [USGS], 1965a, 1965b, 1965c, 1990a, 1990b). The major features include Yuma Mesa to the east, the Yuma Valley to the north, and the Colorado River to the west.

The Yuma Mesa consists of a gently rolling, elevated terrace transition between the Yuma Valley and the Upper Mesa and Gila Mountains to the east. Elevations on Yuma Mesa range from 125 feet near San Luis to 200 feet near Yuma. The Gila Mountains range in elevation from about 600 feet in the outwash area adjacent to the Upper Mesa to about 2700 feet along the crest of the range.

Yuma Valley is primarily a flat flood plain located along the east bank of the Colorado River. The area has been extensively developed for irrigated agriculture and is interspersed with irrigation canals, laterals, and drainage channels. The Yuma Valley slopes gently from approximately 75 feet above mean sea level at the SIB, to about 125 feet above mean sea level near Yuma.

GEOLOGY

The 5-mile zone lies in the Basin and Range geologic province, which is characterized by numerous mountain ranges that rise steeply from large, plain-like valleys or basins. The mountainous regions consist primarily of igneous, metamorphic, and sedimentary rocks. Within the valley or basin regions, deposits of gravels, sands, silts, clays, marl, gypsum, and salt predominate (Hendricks, 1985: 17, Plate 3). The 5-mile zone is wholly contained within one of those broad valleys or basins. **Map V-1** shows the geology of the 5-mile zone.

The Gulf of Mexico formed during the Triassic epoch and Mesozoic era, about 200 million years ago. Much later, within the last million years (during the Pleistocene epoch), alpine glaciers covered the high mountains of Colorado, Wyoming, and Utah.

When these glaciers melted, large amounts of sediments were deposited along the Colorado River, filling the upper end of the Gulf of Mexico and forming the current land forms.

The existing mesas and river terraces are remnants of an extensive former valley and delta plain of the Colorado and Gila Rivers. Yuma Mesa represents the principal river terrace in the area. The dominant materials of the terrace are fluvial gravel, sand, and silt that are overlain in places by windblown deposits.

SOILS

Affected Environment

The soils of the 5-mile zone can be very productive under irrigation because of the year-long growing season. Alfalfa yields can be up to 9 tons per acre and cotton yields up to 1,900 pounds per acre on the lower terraces. Soils on the upper terrace have lower yields and require more intensive management because of the higher erosion hazard. Because of the very low rainfall, non-irrigated range yields are low, averaging about 500 pounds per acre. The following paragraphs describe the soils on the upper and lower terraces. Most of the 5-mile zone soils are on the upper terrace. **Map V-2** shows the soil associations of the 5-mile zone.

The soils of the upper terrace, or Yuma Mesa, are comprised of Rositas and Superstition soil series. These are deep, level to undulating, somewhat excessively drained, sandy soils on old terraces, alluvial fans, and sand dunes. The Rositas sands formed in mixed sandy, windblown material with slopes of 0 to 20 percent. The Superstition sands formed in mixed, sandy alluvium with slopes of 0 to 3 percent. These soils have slight limitations for most kinds of community development, severe limitations for recreation development, poor to very poor potential for wildlife habitat, and a high wind erosion hazard. They are used for growing irrigated hay, cotton, grain, and citrus crops.

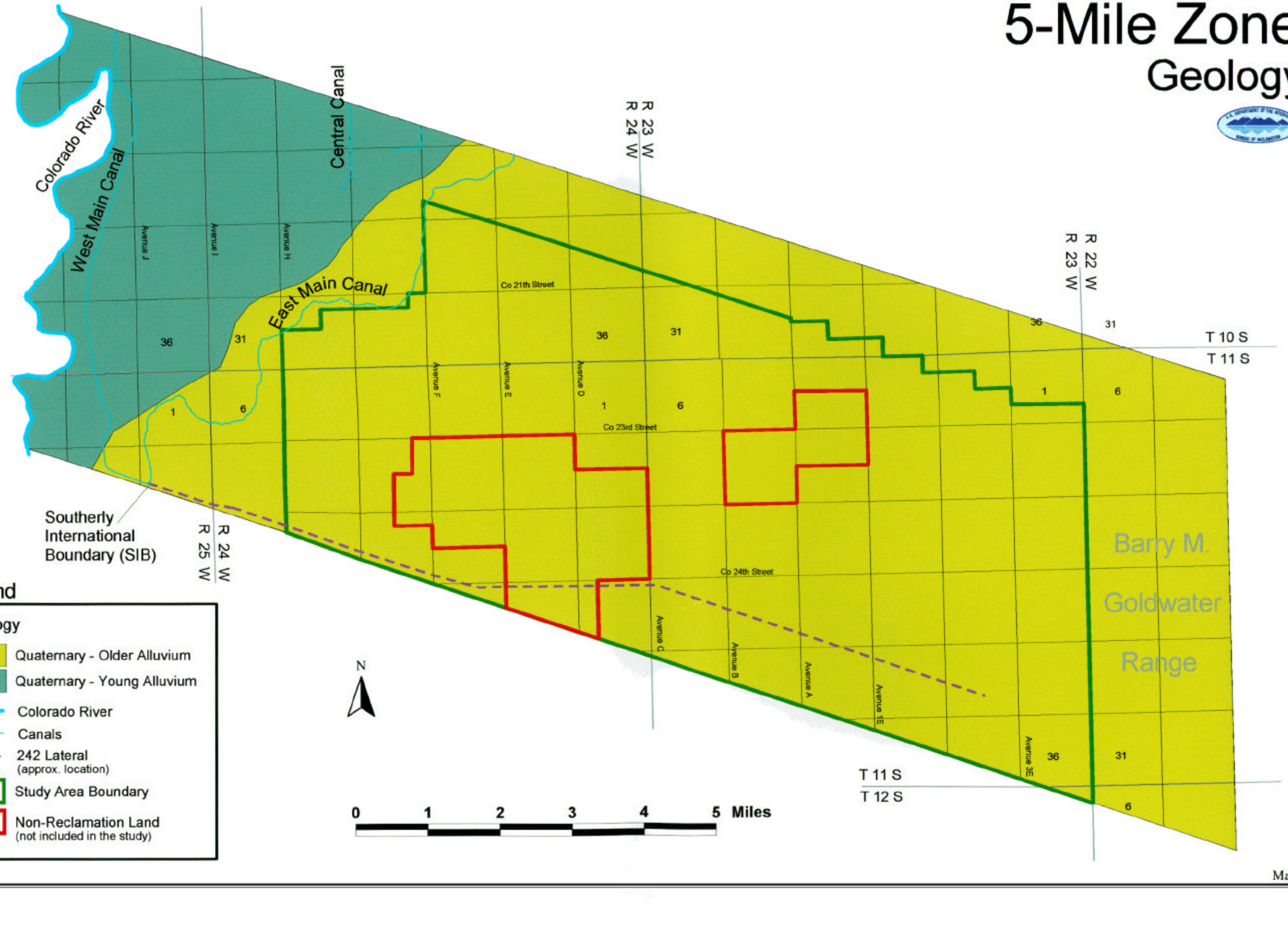
The soils of the lower terraces and flood plain are comprised mainly of Holtville, Gadsden, and Kofa soil series. These are deep, nearly level, well drained, clayey soils. They are used for growing irrigated cotton, hay, small grains, and vegetables. They have limited use for sanitary facilities and community development because of slow permeability and high shrink-swell potential of their clay layers. They have moderate to severe limitations for recreational development.

Environmental Consequences

Alternative A

Under Alternative A, the Border Patrol's increased security zone, new drag roads, and surveillance towers will likely increase the potential for wind erosion of soils. A new utility corridor along 23rd Street and new roads and highways also will increase wind erosion potential.

5-Mile Zone
Geology



Legend

Geology

- Quaternary - Older Alluvium
- Quaternary - Young Alluvium
- Colorado River
- Canals
- 242 Lateral (approx. location)
- Study Area Boundary
- Non-Reclamation Land (not included in the study)

Map V - 1

5-Mile Zone
Soil Associations

Colorado River
West Main Canal
Central Canal
East Main Canal
Southerly International Boundary (SIB)
R 24 W
R 25 W
R 23 W
R 24 W
R 22 W
R 23 W
T 10 S
T 11 S
T 11 S
T 12 S
Co 21th Street
Co 23rd Street
Co 24th Street
Avenue J
Avenue I
Avenue H
Avenue F
Avenue E
Avenue D
Avenue C
Avenue B
Avenue A
Avenue 1E
Avenue 3E
Barry M. Goldwater Range
N
0 1 2 3 4 5 Miles

Legend

Soil Associations

- Gadsden Clay
- Glenbar Silty Clay Loam
- Kofa Clay
- Holtville Clay
- Indio Silt Loam
- Indio-Lagunita-Ripley Complex
- Lagunita Loamy Sand
- Ripley Silt Loam
- Rositas-Ligurta Complex
- Rositas Sand
- Superstition Sand C
- Water
- Study Area Boundary
- Non-Reclamation Land (not included in the study)
- Canals
- 242 Lateral (approx. location)

Map V - 2

Alternative B

The effects of Alternative B would be the same as for Alternative A, except that eliminating recreational OHV use would decrease wind erosion in denuded areas.

Alternative C

The effects of Alternative C would be the same as for Alternative A. In addition, protection would need to be provided to prevent erosion of soil during construction of campgrounds, day use facilities, and trails. Allowing recreational OHV use in certain areas would increase wind erosion of soil.

Alternative D

The effects of Alternative D would be the same as for Alternative C, except that eliminating recreational OHV use would decrease wind erosion of soil in denuded areas.

Cumulative Impacts

The Border Patrol's increased security zone and any new drag roads will increase wind erosion, which would be very difficult to mitigate or control and will cause some long-term environmental damage. Construction of new surveillance towers will require wind erosion control during construction, but no long-term impacts should occur. Utility corridors and new highways and roads will require wind erosion control during construction and protection of the borrow areas and paths after construction.

Under Alternatives C and D, wind erosion control will be required during construction of recreation facilities. Long-term protection from wind erosion will be required on roads and on pedestrian areas around campgrounds, day use facilities, and trails. OHV use under Alternative C would increase wind erosion and the potential for increased environmental damage unless it is strictly controlled.

Mitigation

If construction occurs within the study area, native vegetation will be planted in disturbed areas to prevent soil erosion. Soils characteristics and suitability should be considered when planning future development of the 5-mile zone study area.

Residual Impacts

No residual impacts have been identified.

LAND USE AND TRANSPORTATION

Affected Environment

Over the last several years, this rapidly growing area has attracted the interest of municipal and county planners, land developers, State and Federal agencies, and others seeking land for transportation and utility corridors, rights-of-ways, commercial development, and community recreation. The cities of Yuma and San Luis both have annexed portions of the study area and have identified future uses and developments within the annexed lands as part of their long-range planning. Planners also have defined additional transportation and utility corridors throughout the 5-mile zone study area because of the pending development of a new commercial port-of-entry**. Map V-3** shows existing land uses and land use agreements in the 5-mile zone study area.

Private and State of Arizona landholdings also exist within the 5-mile zone. Up to 700 residential units could be developed within the privately owned Hillander "C" Irrigation District tract, which is surrounded by Reclamation land within the 5-mile zone study area. As with any residential development, planners are actively identifying areas for open space, recreation, utility corridors, roadways, and other commercial developments as they plan any potential development of this tract.

Municipal planning considerations in the 5-mile zone study area include the effect of the anticipated rapid growth in the San Luis area, whose population is expected to double within the next 6 years.

Existing Land Uses

The primary existing uses of Reclamation lands within the 5-mile zone are as follows:

- Protective and Regulatory Pumping Unit (PRPU)
- Reclamation's Yuma Desalting Plant sludge disposal site
- Rolle Airfield
- Western Area Power Administration transmission lines and Sonora substation
- United States Border Patrol drag roads and surveillance towers
- Variety of land use authorizations and easements

Protective and Regulatory Pumping Unit

The PRPU is the well field within the 5-mile zone authorized by Section 103(a) of Public Law 93-320 (known as the Colorado River Basin Salinity Control Act of 1974 [Act]). Currently, 21 wells have been constructed in the PRPU and are in use. However, the wells within the study area that are adjacent to Hillander "C" are used less than other wells because of their poor water quality. A total of 44 have been authorized, and

5-Mile Zone
Existing Land Uses

NEXRAD Weather Station
BOR-5-07-34-L0928

Transmission Line
BOR-3-07-L0874

BLM-AR04859
BOR-14-06-303-2538
BLM-06389
BOR-6-07-34-L0550
BLM-A007593
BLM-AR4859
BLM-A2119
BOR-7-07-34-L0996
BOR-0-07-34-L0596
BLM-A16010
BOR-5-07-34-L0948
Metering Station
BOR-9-07-34-L1124
Transmission Line
BOR-5-07-34-L0948

Avenue H
Avenue F
Avenue E
Avenue D
Avenue C
Avenue B
Avenue A
Avenue 1E
Avenue 3E

Co 21th Street
Co 23rd Street
Co 24th Street

R 22 W
R 23 W
R 24 W

T 11 S
T 12 S

1 6 8 10 11 12 13 14 31 36

Note: Notations, such as BOR-L0289 or BLM-A8389, are land use authorizations issued by the Bureau of Reclamation or by the Bureau of Land Management. Agreements are on file at each agency's local office.

N

0 1 2 Miles

Legend

Agreement Activity
- Right of Way
- Transmission Lines

Land Use Agreement #
- BLM-06389
- BLM-A16010
- BLM-A007593
- BLM-A2119
- BLM-AR04859
- BLM-AR4859
- BOR-0-07-34-L0596
- BOR-14-06-303-2538
- BOR-5-07-34-L0948
- BOR-7-07-34-L0996
- BOR-9-07-34-L0705
- Other Land Use Agreements
- Reclamation Sludge Disposal Site
- Rolle Airfield BOR-6-07-34-L0550
- 242 Lateral (approx. location)
- Study Area Boundary
- Non-Reclamation Land (not included in the study)

Reclamation plans to construct and activate the remaining 23 wells in the future. **Photograph V-2** shows the PRPU conveyance system, and **photograph V-3** shows a typical well site.

Reclamation currently has the ability to pump only 125,000 acre-feet a year from the PRPU. Historically, however, the PRPU has pumped 450 to 31,000 acre-feet per year with an average of about 10,400 acre-feet per year. From 1998 through 2002, pumping averaged 3,800 acre-feet per year. All of this pumped water has been discharged across the Southerly International Boundary (SIB) in partial satisfaction of the 140,000-acre-foot water delivery obligations to Mexico. Also see "Groundwater."

Reclamation's Yuma Desalting Plant Sludge Disposal Site

Currently 67 disposal cells have been constructed; and of these, 36 cells have had water treatment sludge placed in them. Four of the cells were used to test construction methods. A cell consists of a polyvinyl chloride lined impoundment into which the calcium carbonate water treatment sludge is pumped and the solids are allowed to settle as the water evaporates. After the water evaporates, the solids (consisting mainly of calcium carbonate) remain in the lined impoundment. Over the 50-year operating life of the Yuma Desalting Plant (designed to actually operate an average of 3 years out of every 10 years, based upon Colorado River salinity requirements), the A-22 waste disposal site may need to occupy up to 1,240 acres. The A-22 site Aquifer Protection Permit No. 100180 was issued in 2003.

Rolle Airfield

Rolle Airfield, originally constructed during World War II on 640 acres, has operated as an auxiliary airfield for the Yuma area for 50 years.

The original lease between Reclamation and Yuma County, dated March 17, 1952, consisted of a "license" to operate, maintain, and manage the airfield. In 1966, the Yuma County Farm Bureau assumed responsibility for the airfield because it was primarily used to support crop dusting operations in the area. The Yuma County Airport Authority assumed responsibility for the airfield in 1972 to provide a site for civilian pilot training as well as to reduce air traffic conflicts at Yuma International Airport.

In 1973, the original lease between Reclamation and Yuma County was extended so that the county could seek State funds for capital improvements. In 1986, the current lease, No. 6-07-34-L0550, was issued for a term of 25 years. In March 2001, an airport master plan was prepared for the Yuma County Airport Authority. The master plan is a comprehensive analysis of airport needs and alternatives and provides direction for future development. The master plan also documents the airfield's potential as an economic asset to Yuma, Somerton, and San Luis to accommodate an expanding aviation industry.

Photograph V-2.—PRPU conveyance system.

Photograph V-3.—PRPU well site.

Western Area Power Administration Sonora Substation and Transmission Lines

The Western Area Power Administration provides power to the PRPU via a 69-kilovolt (kV) transmission line from the Gila substation, located 18.9 miles northeast of the Sonora substation, which is southeast of the PRPU. The Sonora substation, which covers about 1 acre, transmits power to an existing 34.5 kV transmission line via a new 2.6-mile section to the easternmost well site in the well field. This use is authorized under lease Bureau of Land Management (BLM) A-16010.

U.S. Border Patrol Drag Roads and Surveillance Towers

The U.S. Border Patrol maintains numerous drag roads and surveillance towers throughout the study area to help monitor and prevent illegal entry of undocumented aliens into the United States. The Border Patrol currently maintains a 90-foot-wide protective zone along the United States and Mexico border to monitor illegal entry into the United States. No structures are allowed within this protective zone, and the Border Patrol requires full access to the monitor illegal activities. Also see "Proposed Future Uses Pending." **Photograph V-4** shows a drag road in the 5-mile zone study area.

Photograph V-4.—U.S. Border Patrol drag road.

Other Land Use Agreements (Utilities and Roads)

All other land use agreements in effect within the 5-mile zone study area are shown on figure V-1. (Also see **map V-3** for locations.)

Location	Lessee/Permittee	Administering Agency	Activity	Issue Date	Expiration Date	
T. 10 S. R. 23 W., sec. 20	Mountain States Telephone	BOR 14-06-303-3445	Telephone cable	7/1/71	6/30/2021	Not shown on map
T. 10 S., R. 23 W., sec. 27; T. 10 S., R. 25 W., sec. 36; T. 11 S., R. 25 W., sec. 1	Mountain States Telephone	BOR 14-06-303-2538	Crossing agreement to construct telephone cable	3/11/68	3/10/2018	Shown on **map V-3**
T. 10 S., R. 23 W., sec. 27; T. 11 S., R. 24 W., sec. 5, 6; T. 11 S., R. 25 W., sec. 1	Bureau of Reclamation	BLM AR04859	Transmission line	7/23/69	No expiration	Shown on **map V-3**
T. 10 S., R. 23 W., sec.26, 27, 31, 32, 33, 35; T. 11 S., R. 24 W., sec. 2, 4, 5, 6, 7,8, 9, 17; T. 11 S., R. 25 W., sec. 1	County of Yuma	BLM A06389	County road	3/15/76	No expiration	Shown on **map V-3**
T. 11 S., R. 23 W., sec. 5	Arizona Public Service	BOR 9-07-34-L0705	Transmission line	11/30/88	11/29/2038	Shown on **map V-3**
T. 11 S., R. 23 W., sec. 5, 8	Arizona Public Service	BOR 0-07-34-L0597	Transmission line	1/1/90	12/31/2039	Not shown on map
T. 11 S., R. 23 W., sec. 5	Arizona Public Service	BOR 3-07-34-L0874	Transmission line	11/9/93	11/8/2023	Shown on **map V-3**
T. 11 S., R. 23 W., sec. 5, 6, 8; T. 11 S., R. 24 W., sec. 1, 2, 3, 6	U.S. West	BOR 0-07-34-L0596	Telephone line	1/1/90	12/31/2039	Shown on **map V-3**
T. 11 S., R. 23 W., sec. 5, 8	Southwest Gas	BOR 00LL34-1178	Natural gas pipeline	3/21/01	3/20/2026	Not shown on map
T. 11 S., R. 23 W., sec. 6	National Oceanic and Atmospheric Administration	BOR 5-07-34-L0928	NEXRAD weather station	3/15/95	3/14/2045	Shown on **map V-3**
T. 11 S., R. 23 W., sec. 16; T. 11 S., R. 24 W., sec. 16	Arizona Public Service	BOR 5-070-34-L0948	Transmission lines	9/16/95	9/15/2045	Shown on **map V-3**
T. 11 S., R. 24 W., sec. 1, 2, 3, 4, 5	Arizona Public Service	BOR Amend. No. 1, 7-07-34-L0996	Maintenance of trans-mission lines	11/8/96	11/7/2021	Shown on **map V-3**
T. 11 S., R. 24 W., sec. 2	Arizona Public Service	BLM A-2119	Gas pipeline	11/28/69	No expiration	Shown on **map V-3**
T. 11 S., R. 24 W., sec. 5	Arizona Department of Highways	BLM A-034361	Road	11/4/64	No expiration	Shown on **map V-3**
T. 11 S., R. 24 W., sec. 15	Arizona Public Service	BOR 9-07-34-L1124	Metering station	3/23/79	3/22/2049	Shown on **map V-3**
T. 10 S., R. 24 W., sec. 33	Arizona Public Service	BLM A - 007593	Transmission line	9/17/73	9/17/2023	Shown on **map V-3**

Figure V-1.—Other Land Use Agreements in the 5-Mile Zone Study Area.

Proposed Future Uses Pending

Border Protection Zone (Roosevelt Easement) Expansion

The Border Patrol's 90-foot-wide protective zone will be increased to 150 feet along the entire border between the United States and Mexico to better protect Border Patrol agents from stones and other projectiles thrown into the United States. Reclamation supports this expansion and does not anticipate any conflicts with operation of the 5-mile zone, PRPU, or other Reclamation activities near the international boundary (**photograph V-5**).

Photograph V-5.—International boundary.

City of San Luis Sewer and Water Line

The city of San Luis has submitted an application to Reclamation to construct and operate a 24-inch water and sewer utility corridor to service the State of Arizona, Department of Corrections, minimum security prison, and the possible Hillander "C" residential and commercial developments. The utility corridor would parallel 23rd Street. Initial construction and operation of the sewer and water utilities have already begun within existing city of San Luis city limits, and the San Luis High School is already tied to this utility service.

Projects Identified in Municipal and County Planning Documents

City of San Luis Cemetery

The city of San Luis draft general plan identifies an area within the 5-mile zone study area to develop a community cemetery. If a cemetery were to be developed in the future, the city of San Luis would make a formal request to Reclamation to lease or acquire the land. Before finalizing negotiations, future water needs would need to be defined and solutions identified to address water quality requirements needed to sustain such uses. The draft general plan does not contain details of the proposed development. The location of the proposed cemetery is NE ¼ of sec. 4, T. 11 S., R. 24 W.

City of San Luis Golf Course

The city of San Luis draft general plan identifies an area within the 5-mile zone study area to develop a golf course. If a golf course were to be developed in the future, the city of San Luis would make a formal request to Reclamation to lease or acquire the land. The draft general plan does not contain details of the proposed development. Before finalizing negotiations, future water needs would need to be defined and solutions identified to address water quality requirements needed to sustain such uses. The location of the proposed golf course is sec. 3, T. 11 S., R. 24 W.

Transportation

Primary access to the study area is via U.S. Highway 95 from Yuma, Arizona, south to San Luis, Arizona, then east on 23rd Street.

U.S. 95 is the only route that connects the existing port-of-entry in San Luis to Interstate 8 in Yuma. This route also serves the prime agricultural areas of the Yuma Valley, and slow-moving farm equipment affects vehicle speed and roadway capacity. As the Yuma County area continues to grow and cross-border activities increase, the delays caused by farm equipment and the lack of roadway capacity will affect traffic operations even more. The Yuma Metropolitan Planning Organization, in association with other local agencies, has conducted studies since the 1980s to evaluate optional routes. Construction of the ASH is the final result of these transportation studies. (See "Area Service Highway.")

Interstate 8, with more than 6.5 million vehicles a year (18,000 per day), passes directly through Yuma. It connects to San Diego to the west and to Interstate 10 between Phoenix and Tucson on the east. In the city of San Luis, another 2.6 million cars and 46,000 commercial vehicles pass between Mexico and the United States each year. Commercial truck traffic is routed onto the 23rd Street corridor, while cars and local commercial traffic use U.S. 95.

Access to the study area from Mexico is via Mexican Federal Highway 2, which parallels the international boundary, northwest to the boundary crossing at San Luis Rio Colorado, Mexico, and San Luis, Arizona, and north along Mexican Federal Highway 3 to the boundary crossing.

Paved access within the study area is provided by 23rd Street which runs east from San Luis to Avenue B, then north on Avenue B for approximately 3 miles to the northern boundary of the study area. Avenue B continues north until it intersects U.S. 95. Numerous unimproved roads (mostly sand) traverse the study area; the most prevalent one is the Border Patrol road that parallels the international boundary through the study area.

Following are proposed transportation routes within the 5-mile zone study area.

Area Service Highway

Commercial and residential traffic in the San Luis and Yuma area is steadily increasing as a direct result of population growth, the enactment of the North American Free Trade Agreement (NAFTA) initiatives, and industrial growth in Mexico. To meet the needs of the increasing numbers of commercial users, as discussed previously, a new commercial port-of-entry is being constructed at the U.S.-Mexico border, about 5 miles east of the current facility. The proposed ASH will connect the new border crossing to the cities of Yuma and San Luis. A major interchange will be located at 23rd Street and Avenue E.

Specific objectives of the proposed ASH include the following:

- Facilitate travel and goods movement between the U.S.-Mexico border crossing at San Luis and the new commercial port-of-entry and Interstate 8.
- Keep trucks and hazardous cargo away from populated and congested areas.
- Relieve existing and future congestion on U.S. 95 in and between Yuma and San Luis.

The Federal Highway Administration is currently completing an environmental assessment for the proposed ASH project.

U.S. Highway 195 Expansion (Rolle Airfield Service)

Currently, access to Rolle Airfield is via a bumpy, primitive dirt road. With any future expansion and increased use of the airfield, plans call to upgrade the highway access. Yuma County long-range plans identify construction of a major road from the ASH interchange at 23rd Street and Avenue E north along Avenue E to the airfield.

City of San Luis Truck Route (From San Luis to New International Boundary Crossing)

The new commercial port-of-entry will accommodate commercial traffic crossing between Mexico and the U.S. The city of San Luis general plan identifies a route from San Luis to the new port-of-entry for commercial truck traffic. The truck route will parallel the international boundary east from San Luis to 24th Street, then follow 24th Street east to Avenue E, then continue south to the port-of-entry. It will become a major four-lane route with limited access.

Environmental Consequences

Alternative A

Under Alternative A, no comprehensive land use strategy or strategy to limit water use in the study area would be developed, no land transfers or exchanges would be allowed, and existing land uses and cooperation with adjacent landowners would be the same as today. As a result, land use authorizations would continue to be issued on a case-by-case basis, which could lead to conflicting land uses; allow social, physical, environmental, or facility carrying capacities to be exceeded; adversely affect natural or cultural resources; or adversely affect Reclamation's ability to protect PRPU project purposes. Unrestricted OHV use would result in continued adverse effects. Construction of primary roads would be limited to roads already under consideration and would meet the public's need and demand for access.

Alternative B

Under Alternative B, a comprehensive land use strategy would be developed that would emphasize concentrating land uses in the western portion of the study area while protecting and enhancing the eastern portion of the study area (the Yuma Desert Management Area). Additionally, this land use strategy would use tools, such as GIS mapping, to better analyze how soil conditions and other environmental factors affect land use suitability and capability decisions. The land use strategy would also establish carrying capacities to determine the location, type, and appropriate number of facilities to be constructed and those that would provide maximum protection of natural and cultural resources. As a result, natural and cultural resources would benefit.

Alternative B would allow land transfers or exchanges that would benefit natural or cultural resources, while protecting authorized Reclamation purposes. This alternative also would provide additional opportunities to protect and enhance species of concern. Additionally, the base acreage of the study area would not be allowed to decrease, which would maintain Reclamation's ability to protect project purposes.

New land use authorizations in the western portion of the study area would be limited to those that are absolutely necessary and would adhere to the requirements of the 1997 Flat-Tailed Horned Lizard Rangewide Management Strategy. As a result, the flat-tailed horned lizard and its habitat would benefit. Existing land use authorizations would be allowed to continue but would be eliminated when possible. In this way, the land base committed to land uses would be reduced over time, furthering the goals of natural and cultural resources conservation and protection. Alternative B would emphasize conducting ground-disturbing activities in a manner to avoid adverse effects or loss of unique desert habitat. Land use authorizations also would emphasize mitigation for habitat losses.

Alternative B would further minimize adverse effects on the environment by prohibiting any landscaping associated with authorized land uses unless it were efficient (e.g., xeriscaping). Additionally, this alternative would not allow uses or activities that adversely affect water quality or endangered or threatened species or their habitat.

Construction of primary roads would be the same as under Alternative A, and existing primary roads would continue to be maintained to minimize the proliferation of parallel or additional routes. No secondary roads would be constructed. These actions would benefit natural and cultural resources. Additionally, aligning utility corridors with the proposed roadway improvements would minimize environmental disturbance.

The public's need and demand for access would be minimally met.

Alternative C

Like Alternative B, Alternative C would develop a comprehensive land use strategy. However, Alternative C's land use strategy would maximize recreation, community, and commercial development within the study area. Reclamation would attempt to concentrate this development in the western portion of the study area; however, development could be allowed throughout the study area if appropriate mitigation measures for the flat-tailed horned lizard could be achieved. As a result, Alternative C would affect more land within the study area than Alternative B.

Land transfers and exchanges would be allowed (1) to benefit public recreation facilities and opportunities or (2) to accommodate community or commercial development, while protecting Reclamation's project purposes. As a result, less land may be protected for species of concern or as unique desert habitat than under Alternative B. As under the other alternatives, the base land acreage within the study area would not be allowed to decrease.

The issuance of land use authorizations within the study area would be the same as under Alternative B, except that Alternative C would maximize recreation, community, and commercial development. Reclamation would ensure the compatibility of any land use authorizations with recreation, community, and commercial development. As a result, human development could affect more land than under Alternative B. However, Alternative C would better serve the needs of the cities of San Luis and Yuma because it would be easier for the cities to secure land from the 5-mile zone study area for utility corridors, roadways, recreation areas, and other infrastructure development needs.

Primary road construction and major improvements to existing roads would be allowed within the study area to provide needed access to recreation, community, and commercial developments. Secondary roads would be constructed to provide access to campgrounds, day use facilities, and trailheads. As a result, Alternative C may adversely affect more unique desert habitat than Alternatives A or B. Public demand and need for access would be fully met.

Alternative D

Like Alternatives B and C, Alternative D would develop a comprehensive land use strategy. Alternative D's land use strategy would authorize land uses in the western portion of the study area to benefit limited community, recreation, and commercial development and allow land use authorizations within the Yuma Desert Management Area only for public health, safety, and security purposes. As a result, Alternative D

would affect more land than Alternative B but less than Alternative C. However, Alternative D would enhance public safety and security more than Alternative C. All other aspects of land use authorizations would be the same as under Alternative B.

Alternative D would allow the same use of land transfers or exchanges to enhance protection of species of concern or unique desert habitat as Alternative B. However, Alternative D would also allow land transfers or exchanges to benefit limited public recreation, community, and commercial development which could lead to greater adverse effects on the natural environment than under Alternative B.

Secondary roads would be constructed to provide access to campgrounds, day use facilities, and trailheads. Therefore, the environmental effects resulting from the construction of secondary roads would be greater than under Alternatives A or B but less than under Alternative C. Alternative D would allow maintenance on all primary and secondary roads to prevent the proliferation of parallel routes, thereby benefiting natural and cultural resources. Public demand and need for access would be met.

Cumulative Impacts

Both Alternatives C and D would lead to increased visitor use at the same time that the human population of the surrounding area is increasing because of municipal growth. This increased visitation, combined with an increased population, would increase traffic and congestion on the surrounding roads. No other cumulative impacts have been identified.

Mitigation

Under all alternatives, all land use permits would contain specific stipulations to protect existing resources, decrease potential conflicts with adjacent landowners, and prevent land use conflicts within the study area. Additionally, any developments within the Yuma Desert Management Area would require special mitigation to avoid adverse effects or loss of unique desert habitat and mitigate for habitat losses and/or impacts to flat-tailed horned lizard habitat.

Residual Impacts

No residual impacts have been identified.

GROUNDWATER

Affected Environment

Groundwater Availability

Other than the Colorado River, groundwater is the only potentially viable source of water in the 5-mile zone study area. Groundwater in the 5-mile zone originates almost exclusively from the Colorado River, either as direct recharge from the river itself, or from water diverted from the river and applied as irrigation on Yuma Mesa or in Yuma Valley. That portion of water applied as irrigation which neither is consumed by crops nor evaporates directly from the soil percolates down to the water table to recharge the groundwater system.

Reclamation's management priority in the 5-mile zone study area is to control groundwater pumping. As discussed previously, Minute No. 242 limits groundwater pumping in the 5-mile zone to no more than 160,000 acre-feet per year. (See **map V-4** for wells within the 5-mile zone study area and within the entire 5-mile zone on the Yuma Mesa.) The United States delivers about 140,000 acre-feet per year at the SIB in partial satisfaction of its 1.5 million-acre-feet treaty obligation to Mexico. The 140,000 acre-feet is a combination of drainage and unused irrigation water from the Valley Division of Reclamation's Yuma Project and water pumped from the PRPU.

The PRPU began partial operation in 1980. From 1980 through 2002, the average annual pumpage was 10,400 acre-feet, with a high of 31,000 acre-feet in 1991 and a low of 450 acre-feet in 1997. Pumping from the PRPU averaged 3,800 acre-feet per year from 1998 through 2002. All of this pumped water is conveyed into Mexico as part of the 140,000-acre-foot-per-year discharge across the SIB. Additional pumping in the 5-mile zone is done by the Hillander "C" irrigators (averaging about 16,000 acre-feet per year from 1989 through 1999) and by the State of Arizona, Department of Corrections, minimum security prison (averaging about 400 acre-feet per year from 1997 through 2001).

Before extensive irrigation, the nearly exclusive sources of recharge to groundwater in the Yuma area were the Colorado and Gila Rivers, particularly during flood flows when the rivers overflowed their banks inundating the flood plains. With an average of only about 3 inches of precipitation per year, much of which is lost to evaporation, recharge from precipitation in the Yuma area is a very minor source of recharge. Runoff from nearby mountains (where precipitation averages 4 to 6 inches per year) rarely reaches the Colorado or Gila Rivers. Most of this runoff infiltrates in the sandy and gravelly washes. The major part of this infiltrated water is later evaporated or transpired. Only a small portion reaches the water table.

After 1945, when water was diverted from the Colorado River on a large scale to irrigate Reclamation's Yuma Mesa projects, a large groundwater mound formed as a result of field percolation and, to a lesser extent, canal and lateral seepage losses. By the 1960's, the water table at the crest of the mound was more than 60 feet above pre-development levels. This groundwater mound significantly changed groundwater flow patterns in the area. Under predevelopment conditions, the estimated underflow across the SIB

was about 20,000 acre-feet per year. After development of the Yuma Mesa mound and prior to pumping of Mexico's San Luis Mesa well field, the underflow increased to about 49,000 acre-feet per year due to increased southward gradients created by the mound. Mexico began large-scale pumping in 1973 from its San Luis Mesa well field, located just south of the SIB and east of San Luis Rio Colorado. Between 1973 and 1976, annual pumpage from the well field averaged 102,000 acre-feet. The Mexican pumping caused groundwater levels in the southern part of Yuma Mesa to decline and considerably increased the southward hydraulic gradient. In 1976, primarily due to Mexican pumping, the flow across the SIB was estimated to have increased to 75,000 acre-feet per year. Thus the magnitude of the flow across the SIB is highly dependent upon the level of pumping of the San Luis Mesa well field. From 1972 through 1999, the well field's pumping averaged 67,000 acre-feet per year, with a high of 148,000 acre-feet in 1982 and a low of 0 in 1998 and 1999. Pumping of the PRPU could significantly reduce SIB underflow to Mexico, if the level of pumping were sufficiently high. However, the pumping of the PRPU has always been relatively small compared to the level of pumping of the San Luis Mesa well field and so has not appreciably affected the SIB underflow. The volume of water currently stored in the mound is about 1 million acre-feet (assuming a specific yield of 0.25), which is superimposed on the predevelopment storage in the groundwater system.

From 1952 through 1972, the annual flow in the Yuma Valley Main Drain to the Boundary Pumping Plant averaged 126,000 acre-feet. From 1973 through 2002, the flow averaged 95,000 acre-feet. The reason for the drop in drain flow was increased pumping, primarily from the San Luis Mesa well field and Reclamation's Yuma Mesa well field, the latter beginning significant pumping in 1972. Additionally, since 1995, six drainage wells in Yuma Valley have been connected to the Yuma Mesa conduit, resulting in increased discharge of drainage water to the Colorado River above the Northerly International Boundary and less discharge to Yuma Valley drains and the Boundary Pumping Plant.

Reclamation used a groundwater-flow model to estimate the water table decline with full operational pumping in the 5-mile zones of both Mexico's San Luis Mesa well field and the United States' PRPU and pumping in the United States of the Yuma Mesa drainage wells. Results of this modeling indicated that after 50 years of fully developed pumping, the water table would decline more than 100 feet in an elongated central region within the contiguous 5-mile zones. Land subsidence, which has occurred in other areas of large-volume pumping, is not expected to be a significant problem with fully developed pumping of the PRPU and the San Luis Mesa well field in Mexico.

Groundwater Quality

The chemical composition of the native (i.e., pre-irrigation) groundwater in the 5-mile zone is similar to that of recent Colorado River water, except that chloride rather than sulfate is the chief anion constituent. In areas where there has been a history of pumping and irrigation, concentration of chemical constituents has occurred. Also, rising nitrate levels have been observed. According to recent water quality data (1988-99) for the 5-mile zone, total dissolved solids (TDS) ranges from about 800 to 2,300 milligrams per liter (mg/L). The TDS of water in wells near the international

5-Mile Zone

Existing Well Sites Within the Study Area and Vicinity

Colorado River
West Main Canal
Central Canal
East Main Canal
Avenue J
Avenue I
Avenue H
Avenue F
Avenue E
Avenue D
Avenue C
Avenue B
Avenue A
Avenue 1E
Avenue 3E
Co 21th Street
Co 23rd Street
Co 24th Street
Southerly International Boundary (SIB)
R 25 W
R 24 W
R 23 W
R 22 W
T 10 S
T 11 S
T 12 S
Barry M. Goldwater Range
36
31
6
1
10
11
12
13
14
8

Legend

- Wells within the 5-Mile Zone and Vicinity
- Canals
- 242 Lateral (approx. location)
- Major Roads
- BOR Sludge Disposal Site
- Study Area Boundary
- Non-Reclamation Land (not included in the study)

N

0 1 2 3 4 5 Miles

Map V - 4

boundary used to meet the treaty obligation to Mexico ranges from 800 to 1,700 mg/L. In comparison, the average TDS concentration from all wells on the Yuma Mesa is 1,333 mg/L, and the maximum and minimum concentrations are 3,210 and 644 mg/L, respectively. The Yuma Valley average concentration is 1,536 mg/L; maximum and minimum concentration are 2,790 and 518 mg/L, respectively. Changes in the management of surface water on the Yuma Mesa could affect the quality of groundwater in the 5-mile zone study area and of the underflow to Mexico.

Water Rights

The use of water in the 5-mile zone is regulated by (1) a 1989 Reclamation memorandum that is based in part on Public Law 93-320, as amended by Public Law 96-336; (2) Minute No. 242; (3) existing water contracts; and (4) all applicable Federal and State regulations. Public Law 96-336 states that no contract shall be entered into that will impair the ability of the United States to continue to deliver to Mexico, on the Colorado River downstream from Morelos Dam, approximately 140,000 acre-feet of water annually, consistent with the terms contained in Minute No. 242. Therefore, any request for water use from the 5-mile zone study area would be subject to these limitations.

Environmental Consequences

Increased pumping from the aquifer, which could occur under alternatives that allow for development or land transfers or exchanges that would use or require more water, would affect groundwater availability in the 5-mile zone study area. Some water use could occur in the 5-mile zone, west of the study area and outside of Reclamation's jurisdiction, such as near the city of San Luis. Some elements of the alternatives could also affect groundwater quality. Following are the anticipated effects of each alternative.

Alternative A

Under Alternative A, if groundwater were used to meet the water needs of new developments, the aquifer could be lowered. However, the quantities needed should not adversely affect Reclamation's ability to meet its water delivery obligations to Mexico unless total pumpage for the 5-mile zone approaches 160,000 acre-feet per year, the limit stipulated by Minute No. 242. Moreover, if the water supply is obtained from outside the 5-mile zone study area, groundwater within the study area should not be affected.

In the future, irrigated agriculture on the Yuma Mesa likely would continue to lead to degradation of groundwater quality in the study area.

Alternative B

The effects of Alternative B on groundwater availability would be similar to the effects under Alternative A. In addition, Alternative B would allow land transfers or exchanges to benefit natural or cultural resources. If the Hillander "C" tract were exchanged or

transferred and removed from agricultural production, TDS in the groundwater would likely decrease because of decreased consumptive use.

Alternative C

Alternative C would maximize recreation, community, and commercial development within the 5-mile zone study area. Four elements of Alternative C could significantly affect groundwater availability in the 5-mile zone study area: (1) land uses or exchanges or transfers to benefit recreation, community, or commercial development; (2) new land use authorizations for recreation, community, or commercial development; (3) campground development, especially long-term facilities for winter visitors; and (4) day use facilities, including urban recreation such as golf courses and athletic fields, in the western portion of the study area.

Under Alternative C, land use authorizations could be issued within the study area to maximize recreation, community, and commercial development. These new developments would require additional sources of water. If groundwater were the water source, the aquifer would be drawn down, which could adversely affect Reclamation's ability to meet its water delivery obligations to Mexico. Or, if Reclamation restricted the amount of water a land use applicant could pump, the applicant could be adversely affected.

The long-term use campgrounds and other recreational facilities that could be developed under Alternative C would require significant water and sanitary services. If groundwater were the water source, the aquifer would be drawn down, which could adversely affect Reclamation's ability to satisfy its water delivery obligations to Mexico. At a minimum, the cost of pumping groundwater would increase. The more dispersed, limited stay (14-day) campgrounds would not require as much water or as many sewer services as the long-term facilities, and meeting these needs probably would not significantly affect Reclamation's ability to meet its water delivery obligations to Mexico.

Day use facilities proposed under Alternative C could affect groundwater quality in the western portion of the 5-mile zone study area near San Luis. The intensive irrigation needed for facilities such as golf courses and grass athletic fields could result in elevated TDS in groundwater near the water table due to evapotranspiration of applied water and leaching of salts by water percolating through and past the root zone to the water table. Also, percolating water bearing nitrates from fertilizers may cause nitrate levels in the groundwater to rise. If Colorado River water were used instead of pumped groundwater, the water table would tend to rise, and the TDS of the groundwater might increase more slowly or possibly decrease. Nitrates would likely increase, as when pumped groundwater is used.

Other elements of Alternative C would have similar effects on groundwater availability as Alternatives A and B. Overall, the potential effects of Alternative C on groundwater quality depend on whether water for the campgrounds and facilities were obtained from the 5-mile zone groundwater and the type of wastewater treatment to be used. Pumping groundwater could cause local cones of depression in the aquifer and increase water flow from the north, where a groundwater mound currently exists. The northern

groundwater has a higher TDS, which could increase the TDS of existing aquifer water. If the wastewater were treated with septic systems, the water leaching to the aquifer could contain higher TDS and nitrates. If water supplies were obtained from other sources and the wastewater were treated at existing treatment facilities, this alternative would not significantly affect groundwater.

The effect on groundwater quality of removing the Hillander "C" tract from agricultural production would be the same as under Alternative B.

Alternative D

If groundwater pumping were required to meet the water needs of the limited stay campgrounds, it would probably not significantly affect Reclamation's ability to meet its water delivery obligations to Mexico. In general, the adverse effects of Alternative D on groundwater availability would be less than under Alternative C and greater than under Alternatives A and B and should not affect Reclamation's ability to meet its water delivery obligations to Mexico.

The effect on groundwater quality of removing the Hillander "C" tract from agricultural production would be the same as for Alternatives B and C.

Cumulative Impacts

If the additional water for Reclamation developments were obtained from groundwater, pumping could approach 160,000 acre-feet per year, the limit stipulated by Minute No. 242. If Mexico were to pump at a similar level, maximum drawdowns in the aquifer would occur. Costs of pumping would increase due to increased lift. The extent, both horizontally and vertically, of the body of high quality groundwater in/near the 5-mile zone is not well established. Given that a well or group of wells initially are pumping high quality groundwater, the likelihood that the pumped water will deteriorate in quality increases as the pumping rate is increased toward the maximum and as the period of pumping is lengthened.

However, if the Colorado River or some other surface water sources were to supply increased water needs and the excessive pumping is prevented, these effects should not occur. Irrigated agriculture on the Yuma Mesa could result in cumulative adverse effects on groundwater quality in the study area. However, infiltration from irrigation with a surface water source could increase groundwater availability and may improve TDS, depending on the source water TDS and soil salinity.

Mitigation

Careful monitoring of groundwater levels and groundwater quality will be needed to evaluate current impacts and to project or estimate future groundwater levels and quality. If projected groundwater levels or groundwater quality approach unacceptable

limits, appropriate mitigation will be to find an alternate surface water supply to replace all, or at least a sufficient portion of, the pumped groundwater to prevent an unacceptable drop of groundwater levels or degradation of groundwater quality.

Residual Impacts

No residual impacts have been identified.

VEGETATION AND WILDLIFE

Affected Environment

The 5-mile zone is located within the Yuma Desert portion of the Sonoran Desert. The Sonoran Desert encompasses 119,000 square miles in southern Arizona, southeastern California, northern Baja California, and northwestern Sonora. It is the only subtropical desert in North America, and about half of its plant and animal species are tropical in origin. It is also the most complex of the four North American deserts (which includes the Chihuanhuan, Mojave, and Great Basin) and has the greatest number of plant communities.

Slow-falling winter rains from Pacific Ocean storm fronts passing through the Sonoran Desert December through March, and frequent violent summer thunderstorms with heavy rainfall in localized areas are responsible for much of the biodiversity present in the Sonoran Desert (Crosswhite and Crosswhite, 1986). When winter rains are adequate, huge populations of wildflowers and other annuals bloom from February to mid-April. A number of uniquely adapted species, such as the spadefoot toad, exploit ephemeral summer rain storms. The World Wildlife Fund identified this desert as one of the top 233 ecoregions worldwide deserving special conservation measures (Olson and Dinerstein, 1998).

Broad flat plains sparsely vegetated with creosote bush and white bursage characterize the Yuma Desert. To the casual observer, this landscape appears bleak and monotonous, but it is home to a wealth of desert-adapted plants and animals able to flourish in one of the harshest environments on earth. **Map V-5** shows vegetation types within the 5-mile zone. **Photograph V-1** shows typical vegetation in the 5-mile zone study area.

The Sonoran Desert is divided into seven subdivisions, each based on the distinctive vegetation communities shaped by elevation, latitude, geology, soil, and climate (Shreve, 1951). Of these, only two occur in the United States: the Lower Colorado Valley Subdivision, which encompasses the 5-mile zone, and the Upper Arizona Subdivision, in which most of the saguaros and other conspicuous cactus species occur. The remaining five subdivisions are in Mexico.

The Lower Colorado River Valley Subdivision is the largest, hottest, and driest of the seven Sonoran Desert subdivisions. It surrounds the lower Colorado River in parts of four States. Challenging the Mojave Desert's Death Valley as the hottest and driest place

5-Mile Zone
Vegetation

Colorado River
West Main Canal
Central Canal
East Main Canal
Southerly International Boundary (SIB)
R 25 W
R 24 W
R 23 W
R 24 W
R 22 W
R 23 W
T 10 S
T 11 S
T 11 S
T 12 S
Co 21th Street
Co 23rd Street
Co 24th Street
Avenue J
Avenue I
Avenue H
Avenue F
Avenue E
Avenue D
Avenue C
Avenue B
Avenue A
Avenue 1E
Avenue 3E
36
31
1
6
10
11
12
13
14
8
Barry M. Goldwater Range

Legend

Vegetation

- Agriculture
- Intermixed Riparian/Mixed Riparian Scrub
- Mixed Vegetation Types
- Sonoran Creosotebush-Bursage Scrub

- Canals
- 242 Lateral (approx. location)
- Study Area Boundary
- Non-Reclamation Land (not included in the study)

N

0 1 2 3 4 5 Miles

Map V - 5

in North America, summer highs may exceed 120 °F, with surface temperatures approaching 180 °F (82 °C). Annual rainfall in the driest sites averages less than 3 inches, and some areas have gone nearly 3 years without rain (Arizona-Sonora Desert Museum, 1998). The vegetation community in this subdivision reflects this extreme heat and dryness.

Vegetation

Broad, flat valleys with widely scattered, small mountain ranges of mostly barren rock are characteristic of the Lower Colorado River Valley Subdivision. The 5-mile zone within the Yuma Desert consists mostly of low sandy plains dominated primarily by creosote bush (*Larrea divaricata*) and white bursage (*Ambrosia dumosa*) (**photograph V-1)**. These are the two most drought-tolerant plants in North America; but in the driest areas of this subdivision, even they are restricted to drainages courses. Stands of creosote bush and bursage are uniform in spacing, density, and height. Vegetative cover is usually 10 percent of the land surface but can be as low as 3 percent when rainfall is less than 3.9 inches (Crosswhite and Crosswhite, 1982). The creosote bush is often spaced more regularly than the bursage because creosote bush roots contain chemical inhibitors that reduce competition by other plants. White bursage grows better on deep, sandy loams than on deep clay loams that are adequate for creosote bush.

The dominance of creosote bush and white bursage over vast areas is unusual given the wide variety of soil types and depths that usually influence plant species distributions. Shreve (1951) believed that no other shrubs had evolved biological and physiological adaptations sufficient to allow them to compete successfully with creosote bush and bursage in areas of such extremely low rainfall.

Creosote bush uses a variety of methods to harvest soil water, as well as different adaptations to reduce transpiration during periods of water stress (Crosswhite and Crosswhite, 1982). Roots extend not only into the surface layers (0 to 8 inches deep) that saturate during the rainy season, but also into intermediate and deep layers (20 to 39 inches deep) that retain some moisture during the dry season (Solbrig, 1982). This species appears to be able to use water that condenses on the underside of rocks that cool more rapidly than surrounding soil at night (Stark and Love, 1965). The plant may also be able to take up water on leaf surfaces (Stark and Love, 1969; Strain and Chase, 1966). In addition, creosote bush can tolerate some of the lowest levels of tissue water potential among desert plants.

As the amount of sand in the soil increases, creosote bush becomes less common. Big galleta grass (*Hilaria rigida*) becomes more common, along with Indigo bush (*Psorothamnus schottii*) and mormon tea (*Ephedra trifurca*), branching cholla (*Opuntia ramisissima*), and ground cholla (*Opuntia wrightiana*). Species more abundant in washes, but that also occur on the open ground of the plains and lower bajadas[1] (alluvial fans),

[1] Bajadas are gentle slopes that accumulate at the base of rocky hills. They are composed of a mix of boulders, gravel, sand, and silt. Such a complex soil structure retains water and supports a diverse vegetation community.

are western honey mesquite (*Prosopis glandulosa var torreyana*), blue palo verde (*Cercidium floridum*), graythorn (*Condalia lycioides*), tomatillo (*Lycium andersonii*), burrowbrush (*Hymenoclea monogyra*), and *Encelia frutescens*. Other plant species associated with the creosote bush-white bursage community include acacia (*Acacia paucipina*), fourwing saltbush (*Atriplex canescens*), and ocotillo (*Fourquieria spendens*) (MacMahon, 1992; Crosswhite and Crosswhite, 1982; and Arizona-Sonoran Desert Museum, 2000).

Plants in the Lower Colorado River Valley Subdivision are closely associated with drainage features. Runoff from the surrounding mountains and upper bajadas cross the plains and lower bajadas, covering the sandy soil with intricate patterns created by rills (MacMahon, 1992). Such areas with slightly more moisture can increase the plant diversity by permitting establishment of species with high water requirements, such as graythorn, burrowbush, or lycium (*Lycium*). When the drainage pattern is netlike (reticulate), the plants appear to be scattered over the entire surface of the land. When the pattern is branching (dendritic), the vegetation forms in linear bands and more clearly follows the drainage ways.

The level plains found in the 5-mile zone are characterized by windblown sand that settles around the bases of shrubs and grasses (**photograph V-6**). A surface layer of blue-green algae and two ground lichen species, *Lecidia* and *Acarospora*, develop on the surface of level sandy surfaces, stabilizing the sand and preventing continued wind erosion (Crosswhite and Crosswhite, 1982).

Photograph V-6.—Burrow in the soft sand deposited around a creosote bush.

In the driest Sonoran Desert communities, such as that found in the 5-mile zone, up to 90 percent of the plant species are fast growing annuals. Given adequate winter rainfall, these species rapidly exploit available moisture and open areas between the widely spaced perennial creosote bush and bursage. In the occasional wetter year, these ordinarily dull appearing sites produce more than 60 species of annuals, including desert sand verbena (*Abronia villosa*), desert sunflower (*Geraea conescens*), and numerous species of evening primroses (*Camissonia*) and cryptanthas (*Cryptantha*). Wildflower abundance directly correlates to the amount of winter moisture.

Most Sonoran Desert annual species germinate only during a narrow window in the fall and only if there is at least 1 inch of rainfall (Arizona-Sonora Desert Museum, 1998).

Seedlings rapidly produce inconspicuous rosettes of leaves during the mild fall weather and remain flat against the ground, growing slowly through the winter. In spring, the plants rapidly bolt into flower.

The plains and lower bajadas of the Lower Colorado River Valley Subdivision are the harshest environments in the Sonoran Desert. Vegetation follows an elevational gradient, becoming more abundant as elevation and rainfall increases from the level, sandy plains through the lower bajadas to the upper bajadas toward the adjacent mountains. Thee coarser, rockier soils of the bajadas allow better infiltration of the precipitation, better conditions for germination, and establishment of a greater variety of cacti and other perennials (Shreve, 1951).

Wildlife

Much of the Lower Colorado River Valley Subdivision's wildlife are small, nocturnal, camouflaged, and live below ground during the day. Most of the superbly adapted desert specialists and hardy generalists are unobserved by most people. However, this desert supports an abundant and diverse wildlife community, including foxes, coyotes, rabbits, lizards, snakes, and beetles, as well as a wide variety of diurnal lizards and ground squirrels. An understanding of the species that are found in the creosote-bursage plains of the Yuma Desert is essential to the development of a sound resource management plan that protects and enhances this habitat.

Mammals

Mammals are divided into desert specialists and generalists.

Desert Specialists.—The kit fox (*Vulpes macrotis*) prefers sandy soils where it can dig its dens in desert scrub or desert grassland. This fox dens great distances from any water and is able to obtain adequate moisture from its food. Its dens have multiple openings, and it constructs and uses multiple dens throughout the year. The kit fox feeds on kangaroo rats, round-tailed ground squirrels, pocket mice, cottontails and jack rabbits, mice of various species, insects, lizards, and birds.

Kangaroo rats (family Dipodomys) and pocket mice (family Perognathus) are very abundant in the creosote bush-white bursage flats. Usually, at least two species of each are present in any area (Hoffmeister, 1986).

Merriam's kangaroo rat (*Dipodomys merriami*) occurs in any area where the soil can be dug and where a sufficient number of seeds can be harvested and cached. It digs its burrows deep enough to insulate itself from potentially lethal temperatures above 99 °F (37 degrees Celsius [°C]) or below 45 °F (7 °C). Around Yuma, Hoffmeister (1986) found Merriam's kangaroo rat in gravelly soils and sandy washes. This opportunistic feeder relies on seed from grasses interspersed among creosote bush as well as spring annuals and insects. During the winter, it opens surface caches where seeds are stored. Seed caches that are not recovered appear to be important in the dispersal and establishment of various plant species, especially mesquite.

The desert kangaroo rat (*Dipodomys deserti*) inhabits loose, easily diggable sands in the bottoms of washes or the wind-drifted sands partially stabilized by creosote bush. It constructs large tunnels with wide entrances that it usually does not plug. South of Yuma, Hoffmeister (1986) found round-tailed ground squirrels and desert cottontails occupying the same burrow. While tolerant of other species, the kangaroo rat vigorously defends its burrow from other kangaroo rats.

The desert pocket mouse (*Perognathus penicillatus*) is the most abundant pocket mouse in the Sonoran Desert, preferring valley plains with sparse vegetation and loose soil. The kidneys of this species have exceedingly long renal papillae that concentrate urine, reducing water loss (Hoffmeister, 1986). This mouse is also able to burrow into hard-crusted soils by physically chewing its way through the crust. This seedeater can go into a state of topar (inactivity / hibernation) when seeds are not available (MaMahon, 1992).

The little pocket mouse (*Perognathus longimembris*) south of Yuma lives in sandy soil with widely spaced creosote bushes, desert lilies, and verbena (Hoffmeister, 1986). This species is extremely abundant in certain parts of its range. For example, Hall (1946) found this species to be the most abundant mammal in some parts of Nevada; and in some places, he estimated the population to be 400 per acre. In the spring, the little pocket mouse has its peak of greatest activity from about 2 to 5 hours after sunset and another smaller peak again just before sunrise. A bright moon may curtail this activity (Hoffmeister, 1986).

The cactus mouse (*Peromyscus eremicus*) nests in burrows in very open, sparse vegetation. This desert specialist tolerates water deprivation and has a low basal metabolic rate. When deprived of water and food, it enters torpor within 12 hours at any ambient temperature below 86 °F (30 °C) with a significant drop in body temperature and oxygen consumption (MacMillen, 1965). The cactus mouse is rarely encountered above ground in July and August and is probably in torpor.

Fourteen subspecies of Botta's pocket gopher (*Thomomys bottae*) have been noted in Arizona (Hoffmeister, 1986). The subspecies in the Yuma area is *T.b. albatus*, which is characterized by its pale, almost white color; other subspecies range from pale to very dark. The pocket gopher lives almost its entire life below ground in burrows or tunnels that it digs to find tuberous roots, herbaceous plants, grasses, bulbs and roots of weeds, native plants, and shrubs. Burrow length corresponds to the amount of plant cover; in dense plant cover, burrows are shorter than in comparable areas of sparser vegetation. Burrow depth varies with soil conditions. In some rocky areas, burrows are less than 1 foot deep, while in sandy soil near Yuma, burrows can be 3 feet deep (Hoffmeister, 1986). Although the food habits of the desert-dwelling gopher in Arizona has not been studied, Hoffmeister speculates that food must be limiting and critical in the Sonoran desert scrub.

The round-tailed ground squirrel (*Spermophilus tereticaudus*) is common throughout the Sonoran desert in the creosote bush-saltbush habitat with sandy soils deep enough to dig extensive burrows. Burrows may be more than 3 feet deep. While midday summer temperatures can reach 156 °F (69 °C) on the ground's surface, temperatures in the

burrows remain between 72 ° and 77 °F (22 to 25 °C) (Vorhies, 1945). In the Yuma Desert, this squirrel feeds on creosote bush seeds. It spends much of its life from late August through February in hibernation.

Harris' antelope squirrel (*Ammospermophilus harrisii*) occurs sympatrically (closely related species that occur in the same geographic area) through much of its range with the round-tailed ground squirrel. It is found in rockier habitats and rocky slopes. Unlike the burrow openings of the round-tailed ground squirrel, which are in open areas, Harris antelope squirrel burrows are located beneath bushes and rocks. This species is active during the day and does not hibernate. This squirrel is common in the 5-mile zone, where it lives without water most of the year (MacMahon, 1992).

Desert Generalists.—The gray fox (*Urocyon cinereoargenteus*) dens in the ground, rock piles, mine shafts, crevices in cliffs, and hollows in trees. In Arizona, the gray fox has been observed digging a burrow in the mound of a kangaroo rat with the rats still occupying part of the mound (Hoffmeister, 1986). While it is mostly nocturnal, it is often seen early morning or at twilight. It eats small rodents, insects, fruit, and reptiles.

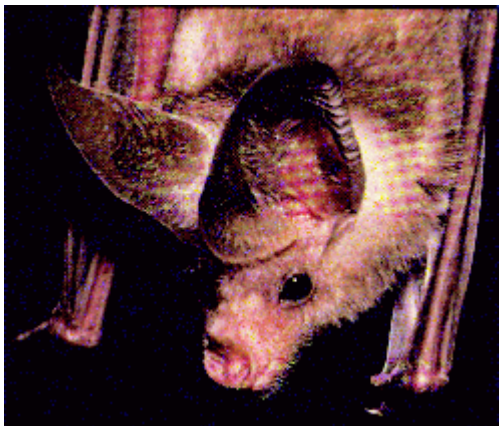
The coyote (*Canis latrans*) is abundant in Arizona, occupying every available habitat. It eats a great variety of plants and animals and, like the gray fox, can often be seen early in morning or in the late afternoon. The coyote is the best runner among the canids, with the ability to leap 14 feet and a normal cruising speed of 25 to 30 mph with bursts to 40 mph (Whitaker, 1980).

The badger (*Taxidea taxus*) in Arizona is most commonly found on the flats and alluvial fans adjacent to desert mountains. It has been found in open deserts many miles from free water. It feeds primarily on burrowing rodent species that it can readily dig out, such as ground squirrels, kangaroo rats, and pocket mice, as well as jack rabbits and cottontails (MacMahon, 1992).

The black-tailed jack rabbit (*Lepus californicus*) can be found in almost any desert habitat. During the day, it rests in forms, or shallow depressions dug by the rabbits, that are usually only a fraction of an inch deep. The rabbit moves from the forms into open places in late afternoon. If the form is in an area with insufficient forage, the rabbit may move up to 1 to 2 miles each way (Vorhies and Taylor, 1933). It consumes mostly mesquite and grasses.

The desert cottontail (*Sylvilagus audubonii*) requires brushier habitats than jack rabbits. It also avoids the midday sun and may enter burrows. The cottontail is more patchy in its distribution; but where it occurs, it is often more numerous (MacMahon, 1992).

Desert Bats.—The California leaf-nosed bat (*Macrotus californicus*) is a highly adapted desert specialist (**photograph V-7**). It is the only leaf-nosed bat species from the tropical bat family *Phyllostomidae* in the Yuma Desert (Hoffmeister, 1986) and is a Federal species of concern. Its ability to hover enables it to search slowly close to the ground and pluck insects, such as caterpillars, directly from foliage. While primarily a visual hunter, it also uses a whispering echo-location call that can be heard no more than 3 feet away, which prevents most prey from anticipating its approach (Tuttle, 2000). It also feeds on large, night-flying beetles, grasshoppers, and moths, which it takes on the wing. This



Photograph V-7.—The California leaf-nosed bat is a year-round resident of the desert scrub feeding on night-flying beetles, grasshoppers, and moths. Photograph from MacMahon (1992).

bat is the only one in North America known to catch caterpillars and is among the very few insect-eating bats that supplement its diets with cactus fruit (Tuttle, 2000). It is a year-round resident in southern Arizona (Hoffmeister, 1986) and roosts in warm mines and caves where temperatures are approximately 84 °F (29 °C).

Nine species of *Myotis* bats occur in Arizona in the 5-mile zone. They are members of the Vespertilionid family. Arizona Myotis species are distributed by vegetation type and elevation (Hoffmeister, 1986). Only three of the nine *Myotis* species are found in the lowest elevations that encompass creosote bush; the cave Myotis (*Myotis vellifer*) is the most strongly associated with this vegetation type. The cave myotis inhabits mine shafts, tunnels, caves, and under bridges in creosote bush, palo verde, brittlebush, and cacti. While it is found in dry areas, it is never more than a few miles from some water, such as canals or rivers. The California Myotis (*Myotis californicus*) inhabits a broad range of vegetative types, including creosote bush. The Yuma Myotis (*Myotis yumanensis*), a Federal species of concern, is strongly associated with rivers, irrigation canals, and ponds and has been observed foraging along the Colorado River (Hoffmeister, 1986).

Five additional species of *Vespertilionid* bats occur in the Lower Colorado River Valley Subdivision. The Western pipistrelle (*Pipistrellus hesperus*) is a year-round resident of southern Arizona. It hunts along canyons, stream beds, and water holes but never far from rocky canyon walls, cliffs, or rocky outcrops where it roosts during the day. It is the smallest U.S. bat and is usually the first bat to appear in the evening. The Southern yellow bat (*Lasiurus ega*) in Arizona is commonly found roosting in Washington fan palms. It emerges early in the evening and feeds on insects. The big brown bat (*Eptesicus fuscus*) is a year-round resident of southern Arizona and is present in creosote bush. It forages frequently during the winter (Hoffmeister, 1986). The hoary bat (*Lasiurus cinereus*) is found throughout Arizona, but in winter only in the southernmost part of the State. The spotted bat (*Euderma maculatum*) is extremely rare and is a Federal species of concern. One was caught about 4 miles south of Yuma and another was found 40 miles east of Yuma (Vorhies, 1935). Habitat requirements are not clearly defined as yet, but it appears that cliffs and rocks are a dominant habitat requirement (Hoffmeister, 1986).

Two species of free-tailed bats (family Molossidae) can be found in the 5-mile zone. The Brazilian free-tailed bat (*Tadarida brasiliensis*) roosts in caves, mines, buildings, bridges, and in desert scrub. It can travel 50 miles in a single evening to find suitable foraging sites. This bat flies high in the sky, feeding on flocks of migratory moths (Tuttle, 2000).

The big free-tailed bat (*Tadarida macrotis*) is not abundant in Arizona but has been found in Sonoran desert scrub. A few may overwinter in southern Arizona, while most migrate south into Mexico (Hoffmeister, 1986).

Birds

The density of breeding bird species can be quite low in deserts. Typical Sonoran Desert sites generally have fewer than 25 breeding bird species (MacMahon, 1992). In the most severe sites, such as a creosote bush flat in the Yuma Desert, there may be only a single breeding species, such as the black-throated sparrow (*Amphispiza bilineta*) (**photograph V-8**). As elevation increases and the vegetation becomes increasingly complex, the number of bird species also increases. On the lower parts of bajadas and on valley plains, there may be no birds or just one for each 3 acres of land (MacMahon, 1992).

Photograph V-8.—Black-throated sparrows thrive in the hottest and driest deserts without water by eating green vegetation and insects. Photograph from MacMahon (1992).

Gambel's quail may be seen near water sources and more succulent vegetation. The greater roadrunner (*Geococcyx californianus*) may be seen in the early morning searching for lizards. The roadrunner mates for life and has a year-round territory. LeConte's thrasher (*Toxostoma lecontei*) prefers creosote bush flats with some chollas for nesting. It feeds on insects found in the litter. The crissal thrasher (*Toxostoma crissale*) prefers denser vegetation along rivers or in large washes. The mourning dove (*Zenaida macroura*) occurs in a wide variety of desert sites, including the creosote bush flats. The verdin (Auriparus flaviceps) and black-tailed gnatcatcher (*Polioptila melanura*) both nest in larger shrubs and subtrees but have been observed feeding in creosote bush, an unusual habitat for desert birds, which seem to avoid this shrub despite its abundance (MacMahon, 1992). The common raven (*Corvus corax*) and turkey vulture (*Cathartes aura*) are common carrion feeders, often seen along roads in the 5-mile zone study area.

The burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), and red-tailed hawk (*Buteo jamaicensis*) are also commonly seen in the 5-mile zone study area (Federal High Administration et al., 2001). Gulls and egrets forage along canals and drains in the agricultural areas adjacent to the 5-mile zone study area.

The Bureau of Land Management's Yuma office publishes a birding checklist with 340 bird species listed. However, most of these species are found in nearby unique habitats, including the Colorado River, Algodones Dunes, Kofa National Wildlife Refuge and Imperial National Wildlife Refuge, or in Mexico.

Reptiles

Reptiles are abundant and diverse in the Sonoran Desert, occupying a wide range of habitats and niches. Lizards and snakes in the Sonoran Desert can be tree dwelling, rock dwelling, detritus dwelling, digging, sand swimming, burrowing, insectivorous, carnivorous, herbivorous, diurnal, and nocturnal (Crosswhite and Crosswhite, 1982).

Adaptations for Extreme Heat and Aridity.—Desert lizards and snakes have developed a number of adaptations to regulate their body temperatures. Periods of peak activity change from midday in the spring and fall to early morning and late afternoon in the summer. For example, the common kingsnake (*Lampropeltis getulus*) and pine-gopher snake (*Pituophis melanoleucus*) normally are diurnal (active during the day) but become nocturnal (active at night) during hot weather.

Nocturnal reptiles, such as the banded gecko (*Coleonix variegatus*) and most snakes, passively exchange heat with the air and soil. In contrast, diurnal lizards absorb heat by basking in the sun. Lizards are able to maintain relatively uniform body temperatures by timing their daily activities, moving in and out of shade, changing body orientation to the sun by adjusting contact with the surface to regulate heat transfer, and by changing color (dark skin absorbs heat faster).

Additionally, some desert reptiles can tolerate high body temperatures. For example, the normal body temperature of a common inhabitant of the Yuma Desert, the desert iguana (*Dipsosaurus dorsalis*), is 114 °F. When this iguana exceeds even this high temperature, it climbs into creosote bushes to reach cooler air layers (San Diego Natural History Museum, 1999). It lives in the sandy plains with creosote bush, which provides food, shelter, and kangaroo rat burrowing sites that it uses to escape predators and extreme heat.

During periods of environmental stress, such as prolonged drought, desert reptiles spend long periods of inactivity in burrows dug by rodents or other mammals. Animals in burrows that hibernate in the winter or estivate in the summer have greatly reduced metabolic processes. They live on water and nutrients stored in the body, while wastes accumulate to potentially toxic levels in the body. For example, the western spadefoot (*Scaphiopus hammondi*) is numerous where soil conditions favor burrowing. Deep burrows provide a suitable microhabitat with moderate temperatures and humidity.

Sand Swimming – Adaptations for Loose Windblown Sand.—Species in the Lower Colorado River Valley Subdivision have a number of specializations for living in loose windblown sand. Sand lizards, a group of five species that includes the fringe-toed lizard (*Uma notata*), Mojave fringe-toed lizard (*Uma scoparia*), greater earless lizard (*Cophosarus texanus*), lesser earless lizard (*Holbrookia maculata*), and zebra-tailed lizard (*Callisaurus draconoides*) are superbly adapted for swimming and breathing in loose sand (MacMahon, 1992). Sand swimming is a strategy used to avoid capture or to avoid extreme temperatures by rapidly burrowing into the sand within 2 to 2.4 inches of the surface. The fringe-toed lizard provides a good example of these adaptations (**photograph V-9**). Its fringed toes act like snowshoes to stop its feet from sinking and provide extra push through sand. Its upper jaw overlaps the lower, preventing the intrusion of sand particles; scaly flaps close against the ear openings when moving

through sand; scales on the upper and lower eyelids interlock to prevent sand from getting into the eyes; and valves in the nostrils can close at will.

Photograph V-9.—Fringe-toed lizards are sand swimmers, burrowing quickly into the sand to avoid predators or to avoid extreme heat or cold. Photo from Behler and King (1991).

Three snake species present in the Yuma Desert are also highly specialized sand swimmers. The banded sand snake (*Chilomeniscus cinctus*) occupies fine sandy areas in open desert dominated by creosote bush. It has a spadelike snout, streamlined head with nasal valves, glossy skin, and angular-ended belly scales to enable it to swim through fine sand. Serpentine-shaped grooves in the sand between bushes reveal its presence. The western shovel-nosed snake (*Chionactis occipitalis*) has a small shovel-shaped head, valved nostrils, flattened belly, and smooth scales which allow this burrower to move quickly through sand. The spotted leaf-nosed snake (*Phyllor-hynchus decurtatus*) is also an adept burrower in sandy creosote bush desert.

Other Reptile Species.—In addition to the sand swimmers discussed previously, other diurnal lizards present in the 5-mile zone include the desert horned lizard (*Phrynosoma platyrinos*) and the flat-tailed horned lizard (*Phrynosoma mcallii*). (Also see "Special Status Species.") These two species freeze if danger approaches when they are out in the open, relying on their camouflage for safety. This strategy, however, does not work well as a defense against vehicles. Crushing by vehicles is a significant source of mortality as OHV use increases and as Border Patrol activities continue.

The herbivorous chuckwalla (*Sauromalus obesus*) prefers open flats and rocky areas, especially where large boulders are present. The side-blotched lizard (*Uta stansburiana*) and western whiptail (*Cnemidophorus tigris*) are abundant in a variety of habitats. The long-tailed brush lizard (*Urosaurus graciosus*) prefers loose sandy desert with abundant creosote bush. Also present are the common tree lizard (*Urosaurus ornatus*) and the desert spiny lizard (*Sceloporus magister*).

Other snakes present in the 5-mile zone include the glossy snake (*Arizona elegans*), western blind snake (*Leptotyphlops humilis*), long-nosed snake (*Rhinocheilus lecontei*), and ground snake (*Sonora semiannulata*), all of which are excellent burrowers in soft sand. Two species of very fast diurnal snakes are the coachwhip *(Masticophis flagellum*) and the western patch-nosed snake (*Salvadora hexalepis*), which like barren creosote bush desert flats. Also present are the night snake (*Hypsiglena torquata*), which hides under rocks or plant litter; the rosy boa (*Lichanura trivirgata*), a nocturnal constrictor; the lyre snake (*Trimorphodon biscutatus*), and the extremely venomous Mojave rattlesnake (*Crotalus scutulatus*). The sidewinder (*Crotalus cerastes*) travels quickly over shifting surfaces using a sidewinding motion in which the snake makes use of static friction to keep from

slipping when crossing soft sandy areas, touching the surface in only two points. It is primarily nocturnal and occupies mammal burrows during the day.

Other toad species present in the 5-mile zone study area include the Colorado River toad (*Bufo alvarius*) and red-spotted toad (*Bufo punctatus*), which prefer damp areas near permanent springs or manmade watering holes.

Threats to the Vegetation and Wildlife of the Yuma Desert Portion of the Lower Colorado River Valley Subdivision

While the native species of the Sonoran Desert are well adapted to its extreme conditions, they are vulnerable to physical disturbance and habitat destruction. Nabhan and Holdsworth (1999) noted that, since World War II, the deserts of the Southwest have been the setting for the largest in-migration in human history. In 1990, the Sonoran Desert Ecoregion had 6.9 million residents, nearly double the 1970 population. The population is expected to reach 12 million by 2020. Under such human growth pressure, the threats to Sonoran Desert biodiversity reported by Nabhan and Holdsworth (1999) will likely become more severe. Conversion of natural habitat to urban, suburban, industrial, and agricultural use has resulted in, and likely will continue to result in, extensive habitat loss (U.S. Department of Defense, 2001). Increased recreational use of the desert is resulting in habitat damage and declines in some species. Additionally, improper livestock management and the spread of invasive plants and animals threaten the viability of both terrestrial and riverine/riparian systems alike.

Recent observations in the 5-mile zone study area indicate that many sections are relatively undisturbed creosote bush—bursage, primarily along the eastern portion of the study area. However, numerous disturbances have been observed, including trash dumping (**photograph V-10**) and numerous Border Patrol roads that are outside the authorized drag roads[2] (**photograph V-11**) and OHV roads. These roads are a significant source of mortality to sand swimming lizards and snakes, which burrow into the shallow top layers of soil and can be crushed, as well as to flat-tailed horned lizards and desert horned lizards, which rely on camouflage for protection. A flat-tailed horned lizard was found crushed on a road near the prison on an October 2001 site visit.

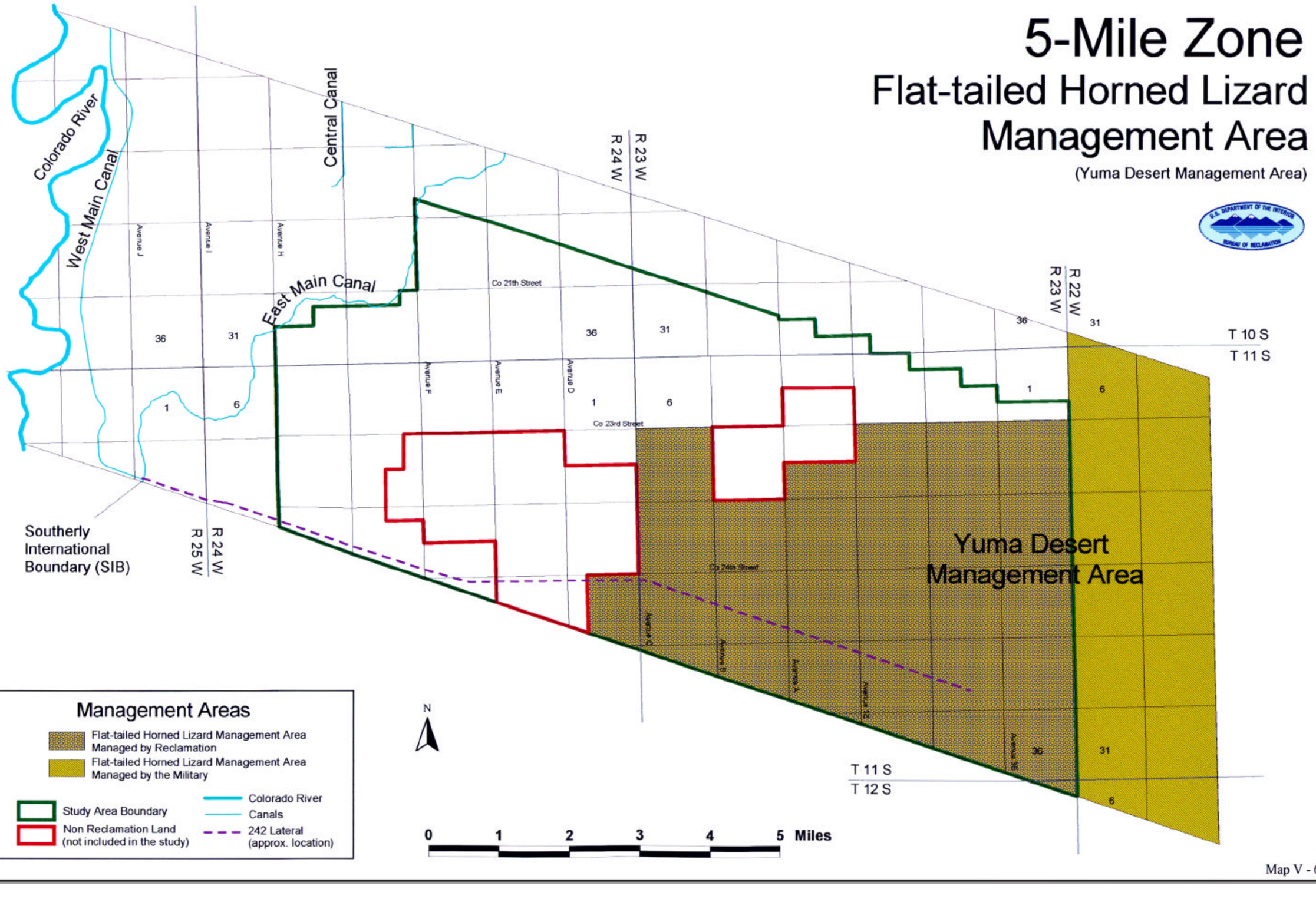
Environmental Consequences

Alternative A

No comprehensive land use strategy currently exists for the 5-mile zone, except for the 16,000-acre Yuma Desert Management Area (shown on **map V-6**), which Reclamation has been managing under the 1997 Flat-Tailed Horned Lizard Rangewide Management Strategy (management strategy). (See chapter II, "Flat-Tailed Horned Lizard Interagency Coordinating Committee.") The Yuma Desert Management Area is subject to special management actions that are the same for all alternatives and which are

[2] Drag road is a method used by the Border Patrol to detect and interpret disturbances in natural terrain conditions that indicate the presence or passage of people, animals, or vehicles.

5-Mile Zone
Flat-tailed Horned Lizard Management Area
(Yuma Desert Management Area)



Map V - 6

Photograph V-10.—Illegal dump sites are common in the undeveloped portions of the 5-mile zone study area.

Photograph V-11.—The Border Patrol maintains the drag road along the International Border. Recreationists create other unofficial roads.

discussed in detail under "Mitigation." Lands outside the Yuma Desert Management Area are primarily in the western portion of the 5-mile zone study area. Under the No Action Alternative, these lands would be considered for development on a case-by-case basis, as under current conditions.

Rapidly increasing human populations and the resulting urbanization in fragile desert environments is the foremost cause of habitat loss and degradation in the Sonoran Desert ecosystem. The No Action Alternative could result in poorly planned growth around San Luis and the new commercial port-of-entry and, in the face of tremendous population growth pressures, could result in leap frog development; poor use of available land; destruction or degradation of natural areas, cultural resources, and sensitive plant and animal life; poorly planned and sited highways and utility corridors; inadequate water supply; and adverse effects on well fields and groundwater.

Increasing population pressures result in more roads, recreational use, and law enforcement needs in the adjacent open lands because of unregulated recreational and OHV use, as well as continued illegal dumping and unregulated shooting. Wildlife habitat becomes increasingly fragmented and degraded. Increasing pressure is placed on Federal agencies—in this case, Reclamation—to convert land use from natural areas to urban uses and to transfer land out of the public domain. The net effect on vegetation and wildlife resources in the 5-mile zone study area under the No Action Alternative would be an overall loss and degradation of habitat, particularly in the western portion of the 5-mile zone study area, where most of the growth pressures are occurring.

No land exchanges would occur under the No Action Alternative. The public land base within the 5-mile zone could be diminished, and opportunities to acquire lands to replace lost wildlife habitat would not occur.

There are numerous ongoing land use authorizations for projects throughout the western portion of the 5-mile zone study area, including the ASH and Rolle Airfield. For some authorizations, such as ASH, mitigation measures have been agreed to. It is unclear, however, how such mitigation measures will be implemented and what entity will ensure that mitigation will be done correctly. For other projects, no mitigation has been received for the losses of wildlife habitat on public land within the 5-mile zone study area. This would continue under the No Action Alternative. New land use authorizations would continue to be considered on a case-by-case basis.

OHV use would continue unchanged, resulting in continued habitat degradation in certain areas, primarily in the western portion of the 5-mile zone study area. New road construction and improvements to existing roads would be permitted on a case-by-case basis. Without an overall strategy for protecting large blocks of intact habitat, fragmentation of habitat could increase.

The current level of agency coordination would continue. Opportunities to cooperate with other agencies to provide law enforcement, as well as to cooperatively develop and implement wildlife and special status species inventory and management projects, and to coordinate with the Border Patrol to reduce OHV impacts on flat-tailed horned lizard and other wildlife species would continue to be lost.

Alternative B

The comprehensive land use strategy proposed under Alternative B would actively discourage growth and growth-promoting activities, such as constructing new roads, widening and paving existing dirt roads, constructing utility corridors, and considering proposals to further develop public lands, in the lands outside the Yuma Desert Management Area. This strategy would benefit vegetation and wildlife in all the remaining Sonoran Desert habitat within this area. Land exchanges would continue, as needed, to prevent the loss of public land in the 5-mile zone study area and would be designed to benefit wildlife rather than to promote recreation, community, and commercial development.

New land use authorizations would be limited only to those for the public benefit. Some land use authorizations have been granted to a number of projects prior to the development of this resource management plan (RMP). Several projects have agreed-upon mitigation measures for wildlife habitat losses that would occur upon project implementation (such as ASH). Alternative B would ensure that agreed-upon mitigation is implemented fully and completely. If no mitigation is in place for losses of habitat on public lands, such mitigation would be developed, agreed-upon, and implemented. All new land use authorizations would require mitigation.

Recreational development would not be allowed within the 5-mile zone study area, which would benefit vegetation and wildlife. Areas damaged by unregulated OHV use would be revegetated. An agreement would be put in place in which Reclamation would install closure signs and the Arizona Game and Fish Department (AGFD) would provide law enforcement to ensure that closures are adhered to, which would greatly benefit vegetation and wildlife. The development and deployment of interpretive signs to educate the public about the Sonoran Desert ecosystem would be beneficial as well.

No new roads or road improvement projects would be permitted, except for those already planned, which would benefit wildlife by retaining large blocks of intact habitat.

Alternative B would actively improve agency coordination. The primary action that would benefit wildlife and vegetation would be implementation of the signing and law enforcement agreement, as discussed previously. Additionally, an agreement between the AGFD and Reclamation to coordinate management of the flat-tailed horned lizard, other special status species, and game species, such as doves, would benefit wildlife. Coordination with the Border Patrol to increase protection for the flat-tailed horned lizard and other wildlife species from OHV use associated with patrol activities would also improve conditions for wildlife.

Alternative C

The comprehensive land use strategy proposed for this alternative would actively encourage community, commercial, and recreational development in the western portion of the 5-mile zone study area, outside the Yuma Desert Management Area. Land use authorizations would favor recreational, community, and commercial

development, rather than natural resource protection, resulting in adverse effects to the remaining relatively undamaged wildlife habitat that exists throughout the western portion of the 5-mile zone study area.

Land exchanges would be conducted to ensure no net loss of public land within the 5-mile zone study area but would benefit community or commercial development, and not necessarily wildlife habitat.

Alternative C would maximize recreational development, with large-scale, long-term (6-month stay) campgrounds and short-term (14-day stay) campgrounds in the western portion of the 5-mile zone study area. These developments would result in significant disturbance and degradation of large areas of remaining relatively intact Sonoran desert. Nonmotorized trails would be constructed within certain areas. The opportunity to manage recreational use, instead of the unregulated recreational use that occurs now, would somewhat offset the habitat degradation and fragmentation that large-scale recreational development would produce. Public education through the use of interpretive signs would be beneficial.

OHV use would be promoted in designated areas, and an OHV plan would be developed. This approach to regulating OHV use would be an improvement over existing conditions. New roads and road improvements would be permitted, as needed, to provide access to developments within the 5-mile zone study area, potentially increasing habitat fragmentation and the risk of increased vehicle collisions with vulnerable wildlife species.

Alternative D

The comprehensive land use strategy proposed for Alternative D, the preferred alternative, would promote limited development in the western portion of the 5-mile zone study area outside the Yuma Desert Management Area,. Land use proposals would be compatible with conservation of the Sonoran Desert habitat that exists within the study area. This land use strategy would protect wildlife and vegetation habitat in the 5-mile zone study area. Currently, proposals are considered on a case-by-case basis with no overall guidance for protection and management of the habitat that still remains relatively intact within the 5-mile zone study area.

No net loss of land within the 5-mile zone study area would be allowed. Land transfers or exchanges would conserve and protect natural resources and provide for limited recreation, community, and commercial development. This approach could possibly benefit wildlife habitat and the Sonoran Desert ecosystem that exists in the 5-mile zone study area compared to the No Action Alternative and current conditions, in which the public land base can be and has been diminished.

Recreation development would consist of construction of limited, short-term camp-grounds in the western portion of the 5-mile zone study area as well as day use facilities and trails. These facilities would provide an opportunity to control and regulate recreational use as well as an opportunity to educate the public on the unique plants and wildlife present in the Sonoran Desert through an active interpretive sign program.

Vehicle use would be restricted to designated existing roads. All off-road activity would be eliminated, and regulations would be enforced, which would benefit desert wildlife, especially those species such as flat-tailed horned lizard and other sand swimmers that rely on freezing and blending into the environment rather than fleeing oncoming vehicles. No new roads would be permitted (except those associated with ASH, the truck route, and Rolle Airfield), which would protect currently existing blocks of intact habitat remaining in the western portion of the 5-mile zone study area.

See "Special Status Species" for cumulative impacts, mitigation, and residual impacts.

SPECIAL STATUS SPECIES

Affected Environment

In compliance with the Endangered Species Act, Reclamation consulted with the U.S. Fish and Wildlife Service (Service) to obtain a list of Federal special status species that may occur within the 5-mile zone study area (attachment C). These species, along with Arizona State special status species, their status, and their potential for occurrence in Yuma County are listed in table V-1. Species unlikely to occur because of habitat or distribution limitations were omitted from further analysis. General life history information is provided for each species that is known to occur or for which suitable habitat is available.

Table V-1.—Special Status Species for Yuma County, Arizona

Common Name	Status[1]	Potential for Occurrence
Plants		
Peirson's milkvetch *Astragalus magdalenae var Peirsonii*	FT	Possible. Occurs adjacent to 5-mile zone, and potential habitat may exist within it.
Blue sand lily *Triteleiopsis palmeri*	SR	Possible. Very narrow distribution in sand dunes. More common in Mexico. Can potentially grow in sandy habitat.
Sand food *Pholisma sonorae*	SC, HS	Highly likely. It is found along the Mexican boundary below elevation 500 feet in drifting sand.
Gander's cryptantha *Cryptantha ganderi*	SC	Possible. Found in creosote bush scrub and sandy soils in desert dunes. California Native Plant Society lists it as extremely rare.
Dune spurge *Eriphorbia platysperma*	SC	Unlikely. Dune spurge is an extremely rare species known only from a specimen collected near the mouth of the Colorado River, Arizona, and from two collections in the Colorado Desert.
Dune sunflower *Helianthus niveus ssp tephrodes*	SC	Possible. Grows in shifting sand dunes and sandy desert areas adjacent to creosote bush. It is currently found in nearby active dune fields.
Senita *Lophocereus schottii*	SR	Unlikely. Only known site in U.S. is from Organ Pipe National Monument.

[1] FE = Federal endangered; FT = Federal threatened; SC = Federal species of concern; FP = Federal proposed; SR = Arizona Native Plant Law salvage restricted; HS = Arizona Native Plant Law highly safeguarded; WC = wildlife of special concern in Arizona.

Table V-1.—Special Status Species for Yuma County, Arizona (continued)

Common Name	Status[1]	Potential for Occurrence
Plants (continued)		
Straw-top cholla *Opuntia echinocarpa*	SR	Unlikely. Occurs in the Sonoran Desert between elevation 1,000 to 5,000 feet.
California fan palm *Washingtonia filifera*	SR	Unlikely. The only known wild populations are found in canyons of the Kofa Mountains. It has been domesticated and planted extensively throughout southern Arizona.
Kearny sumac *Rhus kearneyi*	SR	Unlikely. Preferred habitat of dry cliffs from elevation 1,000 to 1,500 feet not available.
Parish onion *Allium parishii*	SR	Unlikely. Found on rocky slopes from 3,000 to 4,000 feet in the Kofa Mountains in Yuma County.
Mammals		
Sonoran pronghorn *Antilocapra americana sonoriensis*	FE, WC	Unlikely. Remnant populations exist in areas adjacent to 5-mile zone and along international boundry. Current range maps indicate the closest population is in the adjacent Barry M. Goldwater Air Force Range.
Yuma hispid cotton rat *Sigmodon hispidus eremicus*	SC	Unlikely. Found near Colorado River or along sloughs adjacent to river and in fields with Bermuda grass.
California leaf-nosed bat *Macrotus californicus*	SC, WC	Likely. Found in south half of Arizona in desert scrub.
Pale Townsend's big-eared bat *Corynorhinus townsendii*	SC	Likely. Found throughout Arizona over desertscrub, though not common anywhere.
Yuma myotis *Myotis yumanensis*	SC	Possible. Forages in riparian areas on the Lower Colorado River and along irrigation canals. Roost sites may exist in buildings or bridges. Bats may commute over the 5-mile zone between roosting and foraging habitat.
Greater western mastiff bat *Eumops perotis*	SC	Possible. Prefers desert scrub near cliffs and rugged canyons with abundant crevices (AGFD, 1992). It has also been observed foraging in desert
Spotted bat *Euderma-maculatum*	SC, WC	Possible. Species is extremely rare in Arizona. A specimen was found 4 miles south of Yuma in 1904. Preferred habitat is unclear, but appears to be uneven rocky cliffs within 1 mile of rivers.
Fish		
Razorback sucker *Xyrauchen texanus*	FE	Unlikely. Razorbacks occur in the Lower Colorado River. No suitable habitat exists within the 5-mile zone.
Birds		
Bald eagle *Haliaeetus leucocephalus*	FT	Unlikely. Winters on the nearby Lower Colorado River but no suitable foraging or nesting habitat exists within the 5-mile zone. Eagles may pass over the area during migration.
Brown pelican *Pelecanus occidentalis californicus*	FE	Unlikely. Breeds on the Pacific coast of Baja California. Post breeding wanderers seen along Colorado River in summer. No suitable habitat exists within the 5-mile zone.

Table V-1.—Special Status Species for Yuma County, Arizona (continued)

Common Name	Status[1]	Potential for Occurrence
Birds (continued)		
Cactus ferruginous pygmy-owl *Claucidium brasilianum cactorum*	FE, WC	Unlikely. No suitable habitat (large mesquite, paloverde, ironwood and saguaro) exists within the 5-mile zone.
Southwestern willow flycatcher *Empidonax trailii extimus*	FE, WC	Unlikely. No suitable habitat (riparian areas) exist within the 5-mile zone. May pass through area during migration.
Great egret *Ardea alba*	WC	Unlikely. No suitable habitat (wetlands) exists within the 5-mile zone. May pass through area during summer.
Snowy egret *Egretta thula*	WC	Unlikely. No suitable habitat (wetlands) exists within the 5-mile zone. May pass through area during summer.
California black rail *Laterallus jamaicensis coturniculus*	SC, WC	Unlikely. No suitable habitat (wetlands) exists within the 5-mile zone.
Yuma clapper rail *Rallus longirostris yumanensis*	FE, WC	Unlikely. No suitable habitat (wetlands) exists within the 5-mile zone.
Yellow-billed cuckoo *Coccyzus americanus*	FC	Unlikely. No suitable habitat (riparian forests) exists within the 5-mile zone. Only rarely observed as a transient in xeric desert habitat.
Reptiles		
Flat-tailed horned lizard *Phrynosoma m'callii*	FT	High. Highly suitable habitat exists within the 5-mile zone. Specimens found during October 2001, as well as many other documented sightings (Rorabaugh et al., 1985).
Sonoran desert tortoise *Gopherus agassizii*	SC	Unlikely. AGFD indicates the closest populations exist in the Barry M. Goldwater Range, Yuma Proving Ground and Cabeza Prieta National Wildlife Refuge. Preferred habitats of rocky slopes and bajadas of Sonoran desertscrub not available in the 5-mile zone.
Desert rosy boa *Charina trivirgata gracia*	SC	Possible. Suitable habitat (rocky shrublands and desert) may exist within the 5-mile zone.
Cowles's fringe-toed lizard *Uma notata rufo punctata*	SC, WC	High. Suitable habitat (windblown sand) exists within the 5-mile zone.
Narrow-headed garter snake *Thamnos rufi punctatus*	SC, WC	Unlikely. No suitable habitat (pinon-juniper, oak-pine) in the 5-mile zone.
Mexican garter snake *Thamnophis equis megalops*	SC, WC	Unlikely. No suitable habitat (highland canyons primarily) present.

Plants

Peirson's milkvetch, blue sand lily, sand food, Gander's cryptantha, and dune sunflower are all specialists of active sand dunes. Most are known from nearby active dunefields, including the Algodones Dunes and the Yuma Dunes. Except for sand food, which has been observed colonizing piles of sand excavated from irrigation canals (Barton-Aschman Associates, 2000), it is uncertain if others within this group are currently

present within the 5-mile zone study area because no known surveys have been conducted. It is also uncertain if these species could potentially colonize windblown sandy areas within the 5-mile zone that are not active dune fields.

Peirson's Milkvetch

This species grows on slopes and hollows of windblown dunes just outside the 5-mile zone on the Barry M. Goldwater Range (AFGD scoping comments, July 10, 2001). Potential habitat also exists within the 5-mile zone. This species is vulnerable to OHV disturbance, livestock grazing and trampling, and urban development. It is also vulnerable to random naturally occurring events because of its small population size (Federal Register, 1996).

Blue Sand Lily

This lily has the potential to grow in the sandy habitat in the area. It is vulnerable to OHV disturbance and habitat alterations.

Gander's Cryptantha

The California Native Plant Society lists this species as extremely rare. Its habitat is in creosote bush scrub and sandy soils in desert dunes.

Sand Food

Only the saucer-shaped receptacle of this root parasite is normally seen above ground. This species absorbs water through leaf stomata. During periods of drought stress, water absorbed can move directly into the host plant. Thus, this species is not strictly a parasite. It is commonly 3.5 to 12.5 cm in diameter with numerous tiny, violet-colored flowers opening in successive circles. The long (up to 39 inches), succulent underground stems are attached to the roots of various shrubs. The Papogo Indians used them extensively for food. It is found in southern Yuma County along the Mexican border below elevation 500 feet in drifting white sand. Threats include urban development and OHV disturbance.

Mammals

The California leaf-nosed bat, Yuma myotis, and spotted bat were discussed under "Desert Bats" in the Wildlife section. Additional sensitive bat species potentially found in the 5-mile zone study area include the pale Townsend's big-eared bat and the greater western mastiff bat.

California Leaf-Nosed Bat

This bat is a year-round resident of the Sonoran desert scrub. Roost sites include mines, caves, and rock shelters. The primary threat to this species is human disturbance of the

roost sites, which can cause abandonment, as well as closure of mines. It is unlikely that roost sites exist within the 5-mile zone study area; however, it is likely that this species forages in the area.

Yuma Myotis

This bat is most often found in buildings or bridges and occasionally mines or caves. It forages primarily along riparian areas, particularly along edge habitat. The major threat to this bat is the loss of riparian habitat.

Western Mastiff Bat

This is the largest bat in the U.S., with a 2-foot wingspan. Little is known of its status or behavior because of its selection of roost sites in cliff-face crevices and its habit of foraging high above the ground. Its long narrow wings limit its ability to obtain water to those pond areas that are at least 100 feet long, severely limiting its range. Losses of large natural springs have reduced its distribution.

Pale Townsend's Big-Eared Bat

Townsend's bats are found in arid western desert scrub as well as pine forests. Severe population declines have occurred through its range because of its extreme sensitivity to roost site disturbance.

Spotted Bat

This bat's echolocation frequency is low enough to be audible to humans. It was initially thought to be extremely rare, but subsequently it has been learned the bat occupies a rather large range throughout central-western North America. This bat is difficult to observe and selects roosting sites high in cliff crevices.

Reptiles

The flat-tailed horned lizard and Cowles fringe-toed lizard were discussed previously under "Reptiles."

Flat-Tailed Horned Lizard

The flat-tailed horned lizard was a Federal category 2 candidate for listing as threatened in 1982. It was upgraded to a category 1 species in 1989. In 1993, the Service issued a proposed rule to list the flat-tailed horned lizard as threatened. On July 15, 1997, the Service issued a final decision to withdraw the proposed rule when several State and Federal agencies, including Reclamation, signed a Conservation Agreement (CA) to implement the recently completed Flat-Tailed Horned Lizard Range-Wide Management Strategy (management strategy). (Also see chapter II, "Flat-Tailed Horned Lizard Interagency Coordinating Committee.) On July 31, 2001, the Ninth Circuit Court of

Appeals vacated an earlier ruling from the District Court for the Southern District of California that upheld withdrawal of the proposed listing of the flat-tailed horned lizard as threatened.

On December 26, 2001, the Service issued a notice of reinstatement of the 1993 proposed listing of the flat-tailed horned lizard as a threatened species. On January 3, 2003, the Service issued its final determination to withdraw the proposed rule (68 *Federal Register* [FR]; January 3, 2003). The Service made this determination because it found that threats to the species as identified in the proposed rule are not as significant as earlier believed. It appears that the cornerstone of this decision is based upon the existence of the CA to implement the management strategy. The purpose of the management strategy was to provide a framework for conserving sufficient habitat to maintain several viable populations of the horned lizard throughout its range. As part of the CA, agencies designated five management areas (MAs) meant to be the core areas for maintaining self-sustaining populations of flat-tailed horned lizards in the U.S. One of the five MAs includes the Yuma Desert Management Area, which encompasses 16,000 acres of Reclamation land within the 5-mile zone study area (shown on **map V-6**). While all of the conservation measures outlined in the CA have not yet been implemented, the Service felt actions that have been, and are being, implemented do provide protection for the flat-tailed horned lizard and its habitat and have contributed to reductions in specific threats to the species. The Service states that the management strategy / CA has been the main regulatory mechanism established for the conservation of the flat-tailed horned horned lizard throughout its range.

It is assumed that the signed CA will not be changed as a result of the final decision to withdraw the proposed listing and that actions outlined under the management strategy would continue to be implemented. Reclamation will continue to manage the 16,000 acres of the Yuma Desert Management Area pursuant to management strategy guidance. However, Reclamation reserves the right to maintain the existing PRPU authorized by Public Law 93-320. Reclamation also reserves the right to expand the PRPU but would coordinate any such activity closely with the Service to minimize impact to the horned lizard.

In Arizona, the flat-tailed horned lizard is found in the creosote - white bursage series of Sonoran desert scrub. This is an open community associated with sandy flats and valleys, as well as areas with a veneer of fine, windblown sand. The 16,000-acre Yuma Desert Management Area encompasses the best remaining relatively undisturbed creosote - white bursage community in the 5-mile zone. Habitat destruction from urbanization and agricultural development and direct mortality from OHVs are the primary threats to this species.

Cowle's Fringe-Toed Lizard

Cowles's fringe-toed lizard has similar habitat requirements as flat-tailed horned lizards, preferring fine, wind-blown sandy substrates. They are usually more associated with active sand dunes than flat-tailed horned lizards; however, they were observed in several locations in the 5-mile zone during a 1985 survey for flat-tailed horned lizards (Rorabaugh et al., 1985).

Desert Rosy Boa

Desert rosy boa is a powerful constrictor that preys on small mammals and birds. It prefers moist areas around springs or permanent streams in rocky desert areas.

Environmental Consequences

Alternative A

Under the Alternative A, rapidly increasing human populations would continue to result in disturbance, degradation, and loss of habitat for special status species. Land use authorizations could potentially remove suitable habitat from public land ownership. Unregulated and illegal OHV use of the public lands would continue to degrade habitat and result in continued death and injury of wildlife species, such as the flat-tailed horned lizard that freeze in the path of rather than flee oncoming vehicles. No surveys for other special status species would be conducted during suitable conditions, and no individual special status species management plans would be developed to protect those resources.

Alternative B

Alternative B would provide the maximum protection and restoration of habitat for special status species. The comprehensive land use strategy would actively discourage growth and would consider only land use authorizations that would benefit natural resources. Land exchanges would result in no net loss of public lands within the 5-mile zone study area and would benefit natural and cultural resources. Recreational OHV use would be eliminated throughout the 5-mile zone study area, and Reclamation and AGFD would reach an agreement for signing and enforcement of OHV closures. Additionally, Reclamation would identify cooperative projects with AGFD to inventory and manage special status species.

Alternative C

Among all the alternatives, Alternative C would result in the greatest adverse effects on the flat-tailed horned lizard and other special status species. It would maximize community, recreational, and commercial development in the western portion of the 5-mile zone study area. While land transfers or exchanges would result in no net loss of public lands within the 5-mile zone study area, those exchanges primarily would benefit recreation, community, and commercial development, rather than maximize wildlife benefits. OHV use would be regulated. Specific areas would be designated for OHV use, and habitat within these designated areas would be degraded, particularly for species such as the flat-tailed horned lizard. Large-scale, long-term camping would degrade the quality of large areas of habitat.

Alternative D

Compared to Alternative A, Alternative D would provide better protection for the flat-tailed horned lizard and other special status species. The comprehensive land use strategy would allow for limited development in the western portion of the study area. Land use proposals would be compatible with conservation. Land transfers and exchanges would benefit limited recreation, community, and commercial development or natural or cultural resources. Reclamation and AGFD would coordinate to provide law enforcement as well as to develop inventory and management plans for special status species.

Cumulative Impacts

Actively limiting development on Reclamation lands in the western portion of the 5-mile zone study area will benefit vegetation, wildlife, and special status species. Eliminating OHV use, developing recreational facilities that better manage human use, and establishing law enforcement with AGFD will also benefit desert wildlife and vegetation. Establishing comprehensive planning that actively manages growth will prevent the continued loss of habitat.

Mitigation

The following mitigation measures are from the 1977 Flat-Tailed Horned Lizard Recovery Plan. They are summarized here to emphasize the importance of implementing these measures and the need to establish a mechanism to ensure that they are implemented in the 5-mile zone study area. Additionally, these mitigation measures are intended to apply to lands outside flat-tailed horned lizard management areas. Additional mitigation guidance is provided for the acquisition of land when land exchanges are contemplated.

- Define and implement management actions necessary to minimize loss or degradation of habitat.
- Mitigate and compensate project impacts to flat-tailed horned lizard habitat both within and outside the Yuma Desert Management Area.
- Construction related mitigation measures include the following:
  - Limit surface-disturbing activities to the dormant period for the flat-tailed horned lizard (November 15 through February 15).
  - Develop and implement a worker education program.
  - Locate surface-disturbing project outside Yuma Desert Management Area as much as possible. If a project must be located within the Yuma Desert Management Area, try to locate in a previously disturbed area or in an area with poor habitat quality.

- Designate a field contact representative that will have authority to ensure compliance with protective measures, including the ability to halt activities that violate these terms and conditions.
- Project areas should be clearly flagged, and all construction activities should be limited to these areas.
- A biological monitor may be present on construction sites to ensure project activities comply with protective measures, inspect constructed holes and trenches for flat-tailed horned lizards prior to backfilling, and to capture and relocate individuals if necessary.
- Within flat-tailed horned lizard habitat, areas of disturbance of vegetation and soils shall be the minimum required for the project. If possible, specify a maximum disturbance allowable. Vegetation clearing and grading shall be minimized. Wherever possible, use existing highways rather than clearing and grading new right of way.
- Sites of permanent or long-term projects in the Yuma Desert Management Area, where continuing activities are planned and where flat-tailed horned lizard mortality could occur shall be enclosed with flat-tailed horned lizard barrier fencing to prevent lizards from entering project where they may be subject to collection, death or injury. Barrier fencing should consist of 0.5-inch wire mesh fastened securely to posts. Wire mesh should extend at least 12 inches above and below ground.

❖ The project-specific habitat restoration plan should include the following elements:

- Collecting and replacing topsoil
- Preparing seedbeds, fertilizing, and seeding of native species
- Controlling noxious weeds
- Controlling erosion
- Eliminating any hazards to flat-tailed horned lizards such as holes or trenches
- Minimizing disturbance of perennial shrubs during restoration
- Periodically inspecting restored areas

Additional mitigation may be required to compensate for any residual construction impacts that remain.

❖ Limit land use authorizations that cause surface disturbing within the flat-tailed horned lizard Yuma Desert Management Area as follows:

- Every attempt shall be made to locate projects outside of the Yuma Desert Management Area
- New rights-of-way may be permitted only along boundaries of the Yuma Desert Management Area and only if impacts can be mitigated to avoid long-term effects on population of flat-tailed horned lizards in the Yuma Desert Management Area.
- Where discretionary, other new authorizations may be permitted if the habitat disturbance does not pose a significant barrier to lizard movements. Disturbance

shall be limited to 10 acres or less per authorization, if possible. If individual disturbances over 10 acres are necessary, the Interagency Coordinating Committee and the Management Oversight Group shall be contacted to provide suggestions for minimizing potential impacts to flat-tailed horned lizards. The cumulative new disturbance per the Yuma Desert Management Area may not exceed 1 percent of the total acreage. All authorizations must be conducted in accordance with applicable mitigation and compensation.

- All federally owned lands in the Yuma Desert Management Area shall be retained in Federal ownership.
- Maintenance of all existing right-of-way facilities may continue within the Yuma Desert Management Area.
- The proposed ASH is outside of the Yuma Desert Management Area. This and other new road construction along the boundary of the Yuma Desert Management Area shall require fencing to reduce access and lizard exclusion fencing to reduce lizard mortality.

❖ Limit vehicle access and limit route proliferation within Yuma Desert Management Area as follows:

- Reduce new road construction to a minimum by coordinating access needs and avoiding conflicts and replication in road use, development, and management.
- Allow maintenance of roads on a case-by-case basis, recognizing that maintenance of some roads may be necessary to prevent proliferation of parallel routes.
- Any new surface disturbance associated with road maintenance shall require mitigation.

❖ When conducting land exchanges “for the benefit of natural resources” as outlined in Alternative D, the preferred alternative, the following guidelines should be used:

- Large blocks of habitat containing large populations of a target species such as the flat-tailed horned lizard are better than small blocks of habitat containing small populations.
- Blocks of habitat close together are better than blocks far apart.
- Habitat in contiguous blocks is better than fragmented blocks.
- Interconnected blocks of habitat are better than isolated blocks.
- Blocks of habitat that are roadless or otherwise inaccessible to humans are better than roaded and accessible habitat blocks.

While all of these measures apply specifically to protection and recovery of the flat-tailed horned lizard, they also benefit a wide range of plant and wildlife species associated with the flat-tailed horned lizard, thus benefitting a wide range of Sonoran Desert species.

Residual Impacts

Despite improved growth management measures and measures designed to protect Sonoran Desert habitats, urbanization in the rapidly growing area near Yuma, San Luis, and the soon-to-be constructed commercial port-of-entry is likely to continue to exert tremendous pressures on adjacent public lands. Pressure to consider commercial and community development proposals on adjacent Federal land will continue regardless of the presence or absence of a resource management plan. Resisting this pressure will require a great deal of management resolve. Open lands adjacent to large urban areas are subject to increased human demand for unstructured recreational activities, such as driving for pleasure, OHV use, hiking, hunting, bird watching, picnicking, and camping. While these are healthy activities for individuals, when large numbers of people use open lands, habitat degradation can and has occurred. Increasing urbanization in the Sonoran Desert ecosystem cannot be offset by protective measures in the 5-mile zone study area alone.

RECREATION

Affected Environment

While agriculture is the predominant industry in the cities of Yuma and San Luis, tourism is the second largest contributor to the local economy, and many visitors come to the area annually. Figure V-2 shows recreation facilities and attractions in the area. Additionally, military and civilian personnel associated with the Barry M. Goldwater Range often seek outdoor recreation within the area and represent a segment of the area's population likely to participate in active outdoor recreation, especially hunting, off-road driving, and hiking.

Photograph V-12.—Unauthorized OHV use.

Recreation use in the 5-mile zone study area is generally informal, unstructured, and local. No formal studies of recreation use have been conducted; however, local Reclamation and Border Patrol personnel familiar with the 5-mile zone study area have observed that off-road vehicle driving is the most popular recreational activity, followed by nature study and birding. In fact, the area is criss-crossed with two-track routes, although some of the visible off-road vehicle impacts may be attributable to Border Patrol activities. **Photograph V-12** shows off-road vehicle use in the 5-mile zone study area.

Name	Managing Agency	Facilities/Attraction
Imperial Dam	Reclamation	Not applicable
Quail Hill	BLM	Gray water disposal station
Beehive Mesa	BLM	Hiking, nature study, fishing access
Coyote Ridge	BLM	Recreational vehicle (RV) dump station
Cripple Creek	BLM	RV dump station
Skunk Hollow	BLM	Hiking, nature study, fishing access
South Mesa	BLM	Restrooms, RV dump station, water, outside showers, swimming, fishing, shade ramadas, amphitheater
Hurricane Ridge	BLM	
Senator Wash	BLM	Camping, vault toilets, swimming, fishing, boat launching
Squaw Lake Recreation Area	BLM	Restrooms, water, showers, gray water disposal, camping, swimming, fishing, boat launching, picnicking
Hidden Shores	BLM	Overnight camping (tents and RV fees). Trailer hookups, groceries, cafe, laundry, showers, boat rentals, fuel, phone, RV dump station, boat launch.
Laguna Dam	Reclamation	Historically interesting as a first example in this country of the Indian or rock fill type of diversion dam. Fishing access.
Yuma Proving Grounds	U.S. Marine Corps	Hunting is allowed with a State of Arizona hunting license within the State hunting seasons. A special permit issued by the Yuma Proving Grounds is also required. Hunting is restricted to designated areas.
Imperial National Wildlife Refuge	Service	Hunting, fishing, and nature study. Vehicle use is restricted to designated roads.
Kofa National Wildlife Refuge	Service	Hunting, fishing, and nature study. Vehicle use is restricted to designated routes.
Pichaco State Recreation Area	California State Parks	Boating, fishing, hiking, camping
Mittry Lake Wildlife Area	BLM	Camping, fishing, nature study, hunting
Sand Dunes Recreation Area	BLM	Off-road vehicle routes, challenge area

Figure V-2.—Recreation Facilities and Attractions near Yuma, Arizona.

A limited amount of dove hunting also occurs within the 5-mile zone study area. The AGFD would like to see the area remain open and managed for dove hunting. Hunting opportunities for other game species are abundant within lands on the Barry M. Goldwater Range and on the several national wildlife refuges within the region, thus diminishing the importance of the 5-mile zone study area as an area for hunting birds and animals other than doves.

The relatively undisturbed nature of the Sonoran Desert within the 5-mile zone study area offers the opportunity to explore and experience this “oasis” of desert land. The

sandy, creosote-bush-type Sonoran Desert ecosystem, found in abundance within the 5-mile zone, has largely disappeared from the region and has been classified a "Unique Natural Area and Feature" by the Bureau of Land Management.

Off-road vehicle use within the area has potentially adverse effects on the flat-tailed horned lizard, whose habitat is found extensively throughout the 5-mile zone. (Also see "Special Status Species.") Loss of habitat and the resulting decline in population levels brought about the development of the 1997 Flat-Tailed Lizard Rangewide Management Strategy, which discourages activities that could potentially disturb the lizard. Off-road vehicle use can harm the lizard by compacting the top several inches of the friable soils where the lizard seeks shelter and hibernates throughout the colder, winter months. Specifically, the management strategy states, "Vehicle use shall be restricted to designated open and limited routes. . .reduce open and limit route density in management areas (MAs), particularly in portions of MAs where route density is high."

The Flat-Tailed Lizard Rangewide Management Strategy has implications for other recreational uses within the eastern portion of the study area. Competitive recreational events are discouraged. Development of new recreational facilities, such as visitor centers, campgrounds, mountain bike trails, and equestrian trails, are also discouraged. However, non-motorized recreational activities, such as rock hounding, hiking, backpacking, non-vehicle based camping, picnicking, horseback riding, hunting, bird watching, and nature study, can be compatible with management strategy objectives.

The region around Yuma and San Luis offers a variety of recreational opportunities to visitors and residents alike. However, the few visitors to the 5-mile zone study area itself are generally from the local area. More well-known and visited areas within a several hours drive of Yuma and San Luis include locations managed by BLM, Service, Arizona State Parks, and California State Parks.

Both Yuma and San Luis have annexed portions of the 5-mile zone because of their need to expand. Yuma, San Luis, and Yuma County have all recently completed or updated their master plans. These plans address the proposed development of the annexed lands, including requirements for community recreation, parks, and open space. Planning considerations also address the effect of the anticipated rapid growth in the San Luis area. On the basis of historical data, San Luis is expected to double its population within the next 6 years, and the conversion of existing agricultural land to residential use is inevitable. As agricultural land is converted to residential use, the need for community recreation and open space follow. Because of the legal requirements of maintaining the 5-mile zone to meet water delivery obligations to Mexico, a large portion of the Reclamation lands are apportioned to open space, trail corridors, and passive recreation. The one exception is a tract of land that the city of San Luis general plan identifies for future development as a golf course. The city is interested in seeing a golf course constructed but is not interested in operating and maintaining it.

Border Patrol activity has the potential to adversely affect the visitor experience within the 5-mile zone study area. Virtually all vehicles and persons are under some type of observation while within the 5-mile zone study area and visitors can anticipate that

Border Patrol vehicles or aircraft will be dispatched to closely observe any unusual movement or activity. Many recreationists perceive this as an unwelcome intrusion on their solitude and recreational experience.

Environmental Consequences

Alternative A

Under Alternative A, Reclamation would continue to manage recreation and public activities within the 5-mile zone study area according to its ability and authority. If Reclamation receives additional law enforcement authorities, or authority to impose and enforce additional rules and regulations or policies, it would do so as necessary and appropriate. No new recreation facilities are expected to be constructed within the study area, and future recreation demand would not be met.

Existing management practices would allow dispersed and uncontrolled recreation use to continue. Only minimum basic visitor health and safety services would be provided, thereby compromising visitor health and safety. As a result, increased damage to the desert environment from undefined and uncontrolled OHV use and increased trash and dumping would occur, especially as populations increase within the region and more people seek recreational activities within the 5-mile zone study area. Additionally, the quality of the recreational experience for those visitors seeking solitude and nature study most likely would decline and opportunities to interpret the desert environment to further the appreciation and protection would go unrealized.

Alternative B

Under Alternative B, in general, public demand for developed, dispersed, and urban recreation facilities and opportunities would not be met.

Specifically, the demand for campgrounds, day use facilities, trails, and OHV areas would not be met. In addition, the demand for community recreation areas (e.g., soccer fields, ball fields) and open space for relaxation and exercise would go unmet. As the populations of the cities of San Luis and Yuma continue to increase, the demand for areas to accommodate these important social needs also will increase at the same time that opportunities within the 5-mile zone study area are not being provided.

Additionally, city, county, and State land use managers could expect OHV users to be displaced to other, currently unused areas. Vehicular access within the study area would be limited, so nature study enthusiasts, bird watchers, and, to some extent, hunters also could be displaced, especially in the Yuma Desert Management Area.

One advantage of this alternative over Alternative A is that environmental interpretation would be used to communicate positive environmental stewardship messages to promote appreciation and proper use of the desert's natural and cultural resources.

Alternative C

Under Alternative C, which would provide the maximum recreation development among all the alternatives, demand for all types of recreational facilities and opportunities would be most fully met.

Overnight campgrounds and support facilities as well as full-service recreational vehicle campgrounds designed to accommodate extended stays would be constructed. Day use areas would be maximized, and non-motorized, multi-use trails would be developed throughout the western portion of the study area. Designated recreational OHV use areas also would be established in the western portion of the study area. Public motorized access would be limited to OHV use areas or designated roads and trails. Some OHV users could be displaced to other areas, particularly those desiring a less controlled environment.

Urban recreation opportunities, such as golfing, tennis, baseball, and biking, could be accommodated in the western portion of the study area.

This alternative would best meet the needs of the cities of San Luis and Yuma in providing open spaces and recreation facilities for their increasing populations. Additionally, if partners could be found, opportunities exist to cooperatively establish a nature center to interpret the unique Sonoran Desert and to educate the public on the responsibilities of different government entities within the study area. Interpretive signs could also be placed throughout the study area in a further effort to educate and inform the public about the unique Sonoran Desert natural and cultural resources.

By maximizing recreation facility development and providing increased recreational opportunities, carrying capacity limits may be exceeded to the point that user conflicts may increase. The quality of the recreation experience may, therefore, decrease for some users. In addition, as visitor use increases, overcrowding, competition for available space, and overuse and abuse of existing facilities and resources may compromise visitor health and safety.

Additionally, some users who desire a more unconfined and uncontrolled recreation experience may be displaced to other areas outside the study area and closing certain areas, such as campgrounds, day use areas, and sports fields, to shooting sports to protect the safety of other users could displace dove hunters to areas outside the study area. However, the loss of these users should be offset by increases in visitors attracted to increased opportunities and facilities.

Finally, interpretive and educational information would be more readily available, leading to a more enjoyable recreation experience.

Alternative D

This alternative, which allows limited recreation, community, and commercial development, would allow public demand for most types of recreation facilities and opportunities, including urban recreation and open space, to be partially met.

A limited number of day use areas and campgrounds could be developed outside the Yuma Desert Management Area. Day use areas would support nature-based recreation, thereby enhancing opportunities for outdoor photography, hiking, rock hounding, wildlife observation, hunting, and nature study.

Non-motorized, multi-use trails would be constructed in the western portion of the study area. Certain portions of the trails would be paved or hardened to provide access to persons with disabilities. Motorized access would be restricted to designated roads.

Eliminating recreational OHV use would displace those users to other areas, potentially affecting land managers and recreation service providers in these areas. However, eliminating this use would afford the opportunity to rehabilitate existing two-track trails and help protect native plant species and the unique desert habitat. Vehicular access within the study area would be limited, so nature study enthusiasts, bird watchers, and, to some extent, hunters, also could be displaced, especially in the Yuma Desert Management Area.

The recreation experience for people seeking solitude and immersion in natural settings would not be as good as under Alternative B, but better than under Alternative C. Under Alternative D, the emerging need and demand for urban recreation and open space might not be totally met on Reclamation managed lands.

Carrying capacity limitations would be easier to manage and maintain under this alternative. Fewer conflicts would occur between different user groups competing for available space. However, limited development of recreation facilities, such as campgrounds, might lead to unmet public demand for such facilities and conflicts between users competing for the same, limited space.

Opportunities to interpret natural and cultural resources within the study area to promote greater appreciation, proper use, and understanding of the unique desert habitat would be the same as under Alternative B.

Alternative D would provide dove hunters with more hunting areas than Alternative C and fewer areas than Alternative B.

Cumulative Impacts

The cumulative impacts of developing recreation facilities and opportunities within the study area under Alternatives C and D would be the displacement of users desiring solitude and an uncontrolled recreation experience. Therefore, visitation on less managed lands within the region might increase as users are displaced from the 5-mile zone study area to other areas. Restrictions on shooting sports to protect other recreation users could displace dove hunters to other areas.

Similarly, the cumulative impacts of eliminating recreational OHV use under Alternatives B and D would be the displacement of OHV users to other areas within the region.

Mitigation

Under Alternatives C and D, recreation facility development would complement the surrounding landscape as much as practical and would follow strict design and construction criteria, guidelines, and standards. Carrying capacity limits and user demand would be properly determined before major facilities are developed. Bilingual regulatory and informational signage would be posted throughout the area, informing the public of the rules and regulations governing the use of the federally owned lands within the study area. Visitor use would be monitored to identify potential user conflicts and corrective actions to be taken if conflicts are identified.

Residual Impacts

No residual impacts have been identified.

VISUAL RESOURCES

Affected Environment

Generally, visual resources in the northern portion of the 5-mile zone study area have retained a somewhat natural appearance. Only some one-story structures and an occasional tree interrupt the flat expanse of greenish creosote shrubbery and thickets of mesquite. The shrubbery and thickets are interspersed with areas of brownish, sand-like soil.

The central portion of the 5-mile zone study area has expansive views of natural landforms and native vegetation, interspersed with widely scattered facilities, including those of Rolle Airfield and the minimum security prison. The contrast of the urban / agricultural areas and the natural areas provide a change of form, color, and texture within the immediate viewshed.

Some areas of the 5-mile zone study area, particularly those near the newly created border crossing, contain citrus groves. Here, linear plantings of taller bushy trees provide a stark contrast to the native creosote shrubbery and thickets of mesquite. In fact, agricultural development is the prominent feature in the viewshed.

Throughout most of the 5-mile zone study area, construction of any buildings or facilities will require careful planning to reduce visual intrusion. Any structure taller than the relatively low-lying native vegetation will be visible from long distances.

Environmental Consequences

Alternative A

Visual quality could be expected to gradually degrade under Alternative A. The lack of a comprehensive land use strategy would give Reclamation fewer tools to ensure that developed facilities conform with accepted landscape and construction practices designed to minimize visual intrusion on the landscape. Additionally, uncontrolled OHV and motorized vehicle use would lead to eventual destruction of the natural desert vegetation and would leave a maze of visible vehicle tracks in the fragile desert soils.

Alternative B

This alternative would best protect the visual quality of the area because of fewer non-natural intrusions on the visual character of the study area. Also, this alternative would allow the rehabilitation of already visually scarred areas, such as OHV trails.

Alternative C

This alternative would have the greatest adverse effect on the visual quality among all alternatives. Because Alternative C would maximize community, recreation, and commercial development, it would result in the greatest number of non-natural developments, such as buildings, roads, and parking areas, which would intrude on the landscape. Careful and thoughtful design of constructed facilities could minimize degradation of visual resources. However, the potential exists to heavily degrade the visual character of the area because of the study area's relative lack of topographic screening and its sparse desert vegetation.

Alternative D

Alternative D would have less of an adverse effect on visual resources than Alternative C because fewer recreation and land use facilities would be developed, resulting in fewer intrusions on the natural landscape but a greater adverse effect than Alternatives A or B. Rehabilitation of closed OHV use areas would enhance visual quality.

Cumulative Impacts

No cumulative impacts have been identified.

Mitigation

No mitigation has been identified.

Residual Impacts

No residual impacts have been identified.

ECONOMICS

Affected Environment

For purposes of economic analysis, the overall study area is Yuma County, which has experienced significant economic growth in the past decade. Reclamation derived economic data from several sources: Bureau of Economic Analysis, Census Bureau, and Arizona Department of Employment Security. Income and employment are shown for all of Yuma County. Employment is also shown for the city of San Luis (San Luis).

Table V-2 shows Yuma County's total personal income and earnings by industry in 1990 and 2000. From 1990 to 2000, total personal income increased by approximately 77 percent, or a 6-percent average annual increase. Total earnings increased by about 74 percent, or a 5.7-percent average annual increase. In 1990, the largest shares of total earnings for Yuma County were the government (federal / military: 22.7 percent and state / local services: 10.8 percent), services (16.7 percent), and farming (13 percent).

Table V-2.—Personal Income and Earnings, Yuma County
1990 and 2000
($millions)

	1990	2000
Total personal income	$1,453.0	$2,578.1
Earnings by industry		
Farming	$140.7	$249.2
Agricultural services, forestry, fisheries, and other	$72.3	$170.2
Mining	$1.6	$0.5
Construction	$51.0	$128.6
Manufacturing	$58.3	$76.4
Transportation, utilities, and communication	$49.1	$71.2
Wholesale trade	$38.3	$70.6
Retail trade	$101.1	$180.2
Finance, insurance, and real estate	$26.5	$62.0
Services	$180.3	$355.1
Government - Federal and Military	$245.6	$302.2
Government - State and Local	$116.6	$216.3
Total earnings	$1,081.4	$1,882.5

These industries also had the largest shares of earnings in 2000: government (28 percent), services (19 percent), and farming (13 percent).

For the city of San Luis, the 1990 Census showed that more than 70 percent of the working population earned less than $20,000 per year, compared to the State of Arizona, in which only about 35.5 percent of the population earned less than $20,000.[3] Median household income in 1990 in the city of San Luis was $15,554, compared to $27,540 for the State of Arizona. The 2000 Census has not published economic data at this time.

Table V-3 shows total employment and employment by industry for Yuma County in 1990 and 2000. From 1990 to 2000, total employment in the county increased by 31 percent. The largest employers in 2000 were related to the agricultural sector: farming (5.5 percent) and agricultural services (17.6 percent). The service sector (21.2 percent) was the second largest employer, followed by the government (Federal, State, and local) sector (20.2 percent).

Table V-3.—Total Employment and Employment by Industry, Yuma County 1990 and 2000

	1990	2000
Total employment	51,145	67,040
Employment by industry		
Farming	4,296	3,703
Agricultural services, forestry, fisheries, and other	6,760	11,765
Mining	110	[1]0
Construction	1,962	3,395
Manufacturing	2,261	2,428
Transportation, utilities, and communication	1,573	1,853
Wholesale trade	1,662	2,156
Retail trade	8,245	10,787
Finance, insurance, and real estate	2,352	[1]0
Services	9,407	14,233
Government: Federal/military	7,583	6,433
Government: State/Local	4,934	7,099

[1] For these sectors, estimates are not shown to avoid disclosure of confidential information. Estimates are included in the total employment figure.

Table V-4 shows total employment and employment by industry for the city of San Luis in 1990 (from the 1990 Census). Total employment estimates for the city of San Luis are from the Arizona Department of Employment Security and cover the years of 1993 and 2000. Total employment in 1993 was 1,004 full- and part-time jobs. By 2000, employment increased approximately 23 percent to 1,231 jobs. The biggest employers were agriculture (31.8 percent), followed by services (31.5 percent) and retail trade (15.3 percent).

[3] San Luis General Plan, Appendix - Socio-Economic Assessment, David Evans & Associates, April 2001.

Table V-4.—Total Employment and Employment by Industry, City of San Luis

Total employment (Persons over 16 years of age)	956
Total employment by industry	
Agriculture, forestry, and fisheries	304
Mining	22
Construction	31
Manufacturing	72
Transportation, utilities, and communication	51
Wholesale trade	20
Retail trade	146
Finance, insurance, and real estate	0
Services	301
Public administration	9

Table V-5 shows three indicators of economic growth in the San Luis area from 1990 to 1999. During that period, new building permits increased more than 20 times; taxable sales increased more than 50 percent; and net assessed valuations tripled.

Table V-5.—San Luis Growth Indicators 1990 and 2000

	1990	1999
New building permits	26	556
Taxable sales	$33,115,200	$65,513,320
Net assessed valuation	$4,759,686	$14,646,455

Source: Arizona State University, Arizona Department of Revenue

Irrigated agriculture is important in Yuma County and within the study area. The Yuma Project, constructed in the early 1900s, is one of Reclamation's earliest projects. It is divided into two divisions: Reservation Division (14,676 irrigable acres) and Valley Division (53,450 irrigable acres). The Valley Division boundary is just north of the city of San Luis. Another Reclamation project, northwest of San Luis, is the Yuma Auxiliary Project (3,400 irrigable acres), which was first constructed in the 1920s. Rehabilitation and betterment work was completed in the 1965. Table V-6 shows agricultural data from the 1997 Census of Agriculture for Yuma County, and table V-7 shows agricultural data based on the 2000 Arizona Agricultural Statistics publication.

According to Reclamation's Annual Crop Production Report for 1999, the primary crops grown in the Yuma Project, Valley Division, included cotton, wheat, hay ,vegetables, and citrus fruits, with a gross crop value of $226,627,694. For the Yuma Auxiliary Project, the primary crops were alfalfa hay and citrus fruits, with a gross crop value of $3,225,000.

Table V-6.—1997 Census of Agriculture, Yuma County

	1997	1992	1987
Number of farms (irrigated lands)	438	503	548
Irrigated land, harvested crop land (acres)	195,045	188,198	186,318
Market value of agricultural products sold (all lands)	$502,063,000	$402,187,000	$356,150,000

Table V-7.—1999 Crop Production, Yuma County
2000 Arizona Agricultural Statistics

Crops	Acres Harvested	Yield per Acre	Production
Upland cotton	22,400	1,251 lbs.	58,400 bales
Pima cotton	1,800	1,093 lbs.	4,100 bales
Durum wheat	35,300	5,880 lbs.	103,780 tons
Other wheat	1,300	6,420 lbs	4,170 tons
Barley	2,900	5,520 lbs	8,000 tons
Corn (grain)	3,400	10,130 lbs	17,220 tons
Alfalfa hay	30,000	8.3 tons	249,000 tons
Other hay	20,500	4.0 tons	82,000 tons
Vegetables	76,800	309 cwt	23,709,000 cwt
Grapes	1,115	489 ctn	n/a
Citrus fruit	18,300		8,945,000 ctn
Total	213,815		Gross cash receipts = $625,636,000

On the basis of income and employment data, the base or primary industries in Yuma County are agriculture and government. Because of the availability of irrigation water supplies and opportunity to harvest crops several times during the long agricultural season, agriculture and related agricultural services are the primary contributors to the county's economy. The presence of the U.S. Marine air station, as well as other Federal and State agencies, contribute to the government sector of the local economy.

For the city of San Luis, agriculture and related services are the primary contributors to the city's economy. In addition, merchants provide services to people passing through the international boundary area. Industry and commerce have flourished in the area near the port-of-entry because of increased traffic between Mexico and the United States.

Environmental Consequences

Alternative A

New development, including ASH and other new roads and highways, would continue to foster economic growth in the study area.

Alternative B

Transferring or exchanging the Hillander "C" tract and removing this tract from agricultural production would adversely affect the agricultural sector of the economy. Eliminating existing land use authorizations, if possible, also could adversely affect the regional economy, depending on the type of authorization.

If groundwater pumped from the 5-mile zone study area approaches the 160,000-acre-foot-per-year limit stipulated by Minute No. 242, land use applicants within the study area would be required to obtain water from a surface or groundwater source outside the 5-mile zone study area. This water likely would be more expensive, which could adversely affect the land use applicant.

Alternative C

Alternative C's comprehensive land use strategy would encourage commercial development but provide management guidance, which would provide more security for would-be investors than Alternative A and would benefit the commercial and recreation sectors of the economy. Land transfers and exchanges and new land use authorizations could potentially adversely affect the agricultural sector of the economy. However, these adverse effects could be offset by gains to the commercial and recreation services sectors of the economy.

Alternative D

The effect of Alternative D on the economy of the study area would be similar to that of Alternative C, except that net gains in the commercial and recreation service sectors of the economy may be less.

Cumulative Impacts

The potential for decreased land use and water availability in agriculture may further depress the agricultural sector of the regional economy, particularly if this sector is already depressed.

Mitigation

No mitigation has been identified.

Residual Impacts

No residual impacts have been identified.

CULTURAL RESOURCES

Affected Environment

Cultural resources—the remains of past human activity—are finite, nonrenewable, and often fragile. Cultural resources are historic and traditional cultural properties (TCPs) that reflect our heritage. Historic properties include those prehistoric and historic archaeological sites, buildings, districts, and objects eligible for inclusion in the National Register of Historic Places (Register). TCPs are places of special heritage value to contemporary communities (often, but not necessarily, Native American communities) because of their association with the cultural practices or beliefs that are important in maintaining the cultural identity of that community. Federal agencies are required to identify and evaluate the significance of cultural resources located within the area of potential effect (APE) of a Federal undertaking and to evaluate the effect of the undertaking on those resources.

Federal agencies' responsibility to consider and protect cultural resources is based on a number of Federal laws and regulations. In particular, the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations (36 CFR 800), set forth the requirements and process to identify and evaluate cultural resources, assess effects on these resources, and mitigate adverse effects on them that result from a Federal undertaking. Under Section 106 of NHPA, development of a resource management plan is considered a Federal undertaking.

The APE for this analysis of cultural resources is limited to the area that has been defined as the 5-mile zone study area, as shown on **map I-2**.

Historic Setting

Prehistoric Period

It is likely that the lower Colorado River region has been occupied by humans for upwards of 12,000 years. The earliest accepted period of human habitation in the region is associated with the San Diequito Complex. Very little is known about these early desert cultures, but their economy was likely a mixture of hunting and gathering. These early cultures appear to have faded out by about 9,000 before present (B.P.) when Archaic traditions began to move into the region. The Archaic period in western Arizona has been divided into three phases. Phase I (9500-7000 B.P.) is characterized by crude, basally notched, stemmed projectile points. Phase II (7000-400 B.P.) is characterized by the development of manos and metates, and Pinto- and Gypsum-style projectile points. Phase III (about 4000-2000 B.P.) is characterized by an elaboration of stone projectile points, bifacially flaked tools, and the possible production of plain brownware ceramics (Wegener, 1999: 3-4).

As with the earlier traditions, the ceramic period (about 1300 B.P. to the early historic period) in the lower Colorado River area is not clearly understood. The ceramic period has been divided into three phases: Patayan I, II, and III. Phase I, which is the earliest

accepted ceramic stage in southwestern Arizona, spanned from about 1300 to 1000 B.P. The presence of shell and steatite artifacts from California along the Lower Gila River indicates extensive travel and trade during the Phase I period. Major pottery types from this period include Black Mesa Buff, Colorado Beige, and Colorado Red (Sterner and Bischoff, 1997: 9-10).

The Phase II period, about 1000 to 500 B.P., was marked by the expansion of ceramic production up the Gila River and into the California desert. Major types of pottery include Tumco Buff along the Colorado River, Palomas Buff along the Gila River, and Salton Buff at Lake Cahuilla. This period also marked the development of new vessel forms with recurved rims and plaster finishes. Phase III began around 500 B.P. and continued to the early historic period. This phase was marked by the abandonment of previous ceramic styles and the development of new styles such as Colorado Buff. During this period, Patayan ceramics reached their widest geographic distribution, indicating extensive trade networks (Sterner and Bischoff, 1997: 10).

Ethnohistoric Period

At the start of the historic period, about 500 to 400 B.P., the inhabitants of southwest Arizona and the lower Colorado River region were Yuman speaking groups. Yuman speakers are a subgroup of the Hokan language family and can be classified as belonging to one of four geographic groups: the Colorado River Delta (Cocopa, Kohuana, and Halyikwamai), the River Yumans along the Colorado and Gila Rivers (Yuma or Quechan, Mohave, Halchidhoma, and Maricopa), upland Yuman in western Arizona (Yavapai, Walapai, and Havasupai), and western Yumans of the California desert (Diegueno, Kamia, Kailiwa, and Paipai). In addition, the Hia-ced O'odham (a nonfederally recognized tribal group seeking Federal recognition that is currently part of the Tohono O'odham) occupied the inland desert south of the Gila River and may have occupied areas on the eastern margin of the 5-mile zone. The Hopi claim that a number of its clans have histories that place them on the lower Colorado and Gila Rivers.

Agriculture provided 30 to 50 percent of subsistence for the Delta and River groups. No evidence of irrigation works or similar land modification has been located in the lower Colorado River area. Agricultural strategies appear to have been developed to maximize the use of flood waters to provide water for crops. Crops included maize, beans, squash, and melons. Seeds were planted in newly deposited sediments after flood waters had receded. Dietary protein came from fish and small mammals such as rabbits and squirrels and, to a lesser extent, deer and bighorn sheep (Sterner and Bischoff, 1997: 12).

Historic Period

The first non-aboriginal people to enter the region of the lower Colorado River were Spanish explorers in search of gold and other riches in the 1500s. In the 1540s, Hernando de Alarcon reached the mouth of the Colorado River and headed upriver to Yuma Crossing, where he spent several months before returning to New Spain.

Throughout most of the 1600s, the Spanish largely ignored the Yuma area, but when they returned in the late 1600s, they were determined to gain a stronger foothold by converting the native peoples to Christianity. One of the successful missionaries to explore the Southwest was the Jesuit priest Eusebio Francisco Kino. In 1699, Kino explored the Gila River, and the following year, led an expedition to the Gulf of California, crossing the Colorado River at Yuma. Kino noted that the Quechan village at the crossing contained more than 1,000 people.

For most of the 1700s, Yuma was the western edge of Spanish control. In 1780, attempts to establish two missions in the Yuma area were shortlived. The local Quechan Indians resisted efforts by the Spanish Franciscans to "civilize" them, and on July 17, 1781, killed the priests and all Spanish males at the two missions. Few non-Indians entered the area again until the 1820s, when Anglo-American trappers explored the lower Gila River in search of beaver. By the start of the Mexican-American War in 1846, the American presence in the area had been firmly established.

Over the years, Yuma became established as an important trade center. By 1870, Yuma (then known as Arizona City) was the second largest settlement in the Arizona territory, with a population of 1,144. Irrigated agriculture began in the late 1800s and early 1900s, when three private ditch companies were formed to develop and irrigate the bottom lands of the Yuma Valley. Along with the private companies, some individuals and farmers' organizations also attempted irrigation. At about the same time, the newly created United States Reclamation Service (predecessor of the Bureau of Reclamation) also recognized the area's potential for irrigation, and on May 10, 1904, the Secretary of the Interior authorized construction of the Yuma Project. Project work began with the construction of Laguna Dam on July 19, 1905. In addition to Laguna Dam, original project features include the Boundary Pumping Plant, one powerplant, and a system of canals, laterals, and drains. The East Main Canal skirts the northwest edge of the study area boundary, but the study area contains none of the historic Yuma Project's facilities.

Identified Cultural Resources

Research was conducted in September 2001 and consisted of file searches at the Arizona State Parks, State Historic Preservation Office, Phoenix; Arizona Department of Transportation, Phoenix; Arizona State Office of the Bureau of Land Management, Phoenix; and the Arizona State Museum, University of Arizona, Tucson. Phone inquires were made to the Bureau of Land Management, Yuma Area Office; Bureau of Reclamation, Yuma Area Office; Bureau of Reclamation, Lower Colorado Regional Office, Boulder City; and the Arizona State University, Anthropology Laboratory, Tempe. In addition, several online databases were consulted, including the National Register Information System and AZSite: Arizona's Cultural Resource Inventory. A search of Reclamation's real property inventory system was also conducted.

As evidenced by this research, archeologists have paid relatively little attention to the area of the lower Colorado River in comparison to other regions of the Southwest. Early archaeological investigations in the Southwest have generally focused on groups that had rich material cultures, such as the Anasazi, Mogollon, and Hohokam. The region of

the lower Colorado River was largely ignored, possibly due to the loss or destruction of the material remains of the groups that inhabited the area by annual flooding of the Colorado River.

Based on the research conducted in September 2001, only about 10 percent of the lands within the APE have been surveyed for archeological resources, and most of these surveys involved corridor or linear surveys associated with road, pipeline, or power line construction. Only two block surveys of any considerable size have been conducted within the APE.

A total of 11 linear surveys have been conducted in the project area. Two of those surveys run through the APE along the southern border of T. 11 S., Rs. 23 and 24 W., secs. 1, 2, 3, 4, 5, and 6 (Lite, 1996; McQuestion, 1992). Four other surveys covered portions of the Lite and McQuestion surveys within the APE (Crownover, 1996; Effland, 1985; Lite, 1997; Dart, 1994). Lite (1996) reported one site (AZ X:10:17), described as two moderate-to-heavy concentrations of pre-historic ceramic artifacts with no associated lithic or other features. The site was designated as potentially eligible for listing on the National Register of Historic Places under criteria D, i.e., likely to hold important information which will contribute to our understanding of human history or prehistory. Avoidance of the site was recommended. McQuestion (1992) located one isolated find: a scatter of three brownware ceramic sherds. McQuestion also recorded three other isolated finds: a square metal pillbox, one rhyolite primary flake, and one brownware ceramic sherd, but those isolates were outside the APE for this study.

A survey conducted by SWCA Inc., Environmental Consultants (Doke, 1993) for a pipeline right-of-way recorded a single isolated find consisting of a single stuccoware sherd. Four other linear surveys (Middleton, 1981; Courtright, 2001; Potter, 1993; Darrington, 1995) within the APE located no other sites or isolates. One survey located along the international boundary was plotted on a survey map at the Arizona State Historic Preservation Office (SHPO), but no report of the survey findings could be located.

Two block surveys have been conducted in the APE. In 1985, Dewey and Middleton conducted a reconnaissance survey of approximately 1,280 acres covering the south half of sections 3 and 4, and the north half of sections 9 and 10, all in T. 11 S., R. 23 W. No cultural resources were located. In 1999, 360 acres constituting all of section 23 north of the international boundary, and the western quarter of section 24 north of the international boundary in T. 11 S, R. 24 W., were surveyed without locating any prehistoric resources (Wegener, 1999).

Two additional sites were located within the APE using AZSite (Arizona's Culture Resource Inventory internet database) (Arizona State University, et al., 2001). Both sites were recorded in 1987 and are identified by BLM site numbers. Reports or site forms could not be located. Site No. AZ-050-1420 (AZSite No. 74775) was described as a single primary flake in the backdirt of a rodent burrow, indicating possible subsurface deposits. The site is located in T. 11 S., R. 23 W., sec. 25 and is considered eligible for listing on the National Register under criteria D. Site No. AZ-50-1421 (AZSite

No. 74776) is located in T. 11 S., R 24 W., sec. 23 and is described as a "pot smash" site. It is located in the same area surveyed by Wegener in 1999 but was not identified in that survey. It is considered eligible for listing under criteria D.

Few buildings and structures have been recorded within the APE. In 1999, Wegener reported on buildings and structures related to an international border livestock crossing station. Although his survey of the buildings and structures was very basic, he determined that they were not significant. Wegener also noted the existence of the 242 Lateral, which crosses the northern portion of the survey area. He did not record the structure or report on its potential significance.

A search of the records at the State Historic Preservation Office revealed no historic resources recorded within the APE. The East Main Canal, considered a contributing element to the National Register-eligible Yuma Irrigation Project, skirts the northwestern corner of the APE but does not extend into the project area (Pfaff et al., 1992 [1999]). A search of the National Register of Historic Places database showed 67 properties in Yuma County listed on the National Register of Historic Places but none are located within the APE (National Park Service, 2001). A search conducted in Reclamation's real property inventory system did not identify any Reclamation-owned buildings or structures in the APE.

Information about TCPs within the APE is currently not available. During the planning process for any future Federal undertakings within the APE, Reclamation will consult with area Indian tribes to determine if any TCPs would be affected and, if so, will make every effort to avoid those properties.

Conclusions and Recommendations

Because the development of a resource management plan is considered a Federal undertaking under Section 106 of the NHPA, consultation with the SHPO and federally recognized Native American groups who may have an interest in the APE was initiated and is ongoing.

The relatively few archeological sites identified within the APE to date do not indicate the number of sites within the entire 5-mile zone, because, as noted, less than 10 percent of the APE has been surveyed. The number of sites in areas nearby and the rich pre-history of the region suggest that additional sites are likely to exist within the APE. In the absence of a systematic archaeological survey of the APE, intensive surveys of any areas subject to ground-disturbing or potentially ground-disturbing activities will be initiated, in accordance with Section 106 of the NHPA.

Likewise, the lack of historic structures or buildings recorded in the APE does not indicate the number of historic structures that actually exist in the area because a comprehensive survey of structures or buildings has not been conducted. As with the archeological resources, an intensive survey of historic structures would be required before any ground-disturbing or potentially ground-disturbing activities are initiated.

Environmental Consequences

Alternative A

Reclamation would continue to fully comply with Section 106 of the NHPA for Federal undertakings. Reclamation would consult with the SHPO and area Indian tribes, as required by 36 CFR 800, as revised to locate and identify any cultural resources within the study area before initiating any Federal undertaking. However, Reclamation would continue to provide only a limited level of land management oversight. Consequently, adverse effects on cultural resources that might be occurring under existing, largely unregulated land uses, including OHV uses, would continue. Without an RMP, Reclamation would not programmatically plan for necessary additional cultural resource management activities to further survey, test excavate, or protect Register-eligible sites. Instead, cultural resource investigations would occur only in response to each new agency action, without a unified management approach.

Alternative B

Reclamation would comply with NHPA and would consult with the SHPO and area Indian tribes, as required by 36 CFR 800, as revised, as under Alternative A. Additionally, in consultation with the SHPO and area Indian tribes—and based on the Class I survey—Reclamation would develop a research design for conducting Class II or III surveys to determine areas of high or low potential for cultural resources, including traditional cultural properties, within the study area. Reclamation then would conduct intensive surveys of areas with high potential for cultural resources and / or any areas scheduled for ground-disturbing or potentially ground-disturbing activities to locate cultural resources. During ground-disturbing activities, Reclamation would make every effort to avoid significant cultural resources. These actions would further protect and benefit cultural resources in the 5-mile zone study area for the long term.

During construction, if cultural resources are discovered, work in the immediate areas would cease until a qualified archeologist evaluates the site, takes appropriate measures, and consults with the SHPO. Reclamation would ensure that any project-specific agreements regarding cultural resources are included as specifications in construction contracts. Reclamation would also inform construction contractors about the presence of cultural resources within or near the project area and about their protection under Federal and State laws. When granting easements on or across Reclamation-owned lands, Reclamation would review the proposal for potential effects on cultural resources and ensure that the entity receiving the easement complies with all applicable cultural resource laws for any activities within the boundaries of the easement. These actions also would benefit cultural resources.

In addition, eliminating recreational OHV use would protect cultural resources in the study area for the long term.

Alternative C

Under Alternative C, designating certain areas for recreational OHV use could adversely affect cultural resources. However, conducting intensive cultural resource surveys and preparing a comprehensive OHV plan could offset any potential adverse effects.

Alternative D

The effects would be the same as under Alternative B.

Cumulative Impacts

No cumulative impacts have been identified.

Mitigation

Alternative A

Reclamation would continue to fully comply with Section 106 of the NHPA for Federal undertakings, and Reclamation would consult with the SHPO and area Indian tribes, as required by 36 CFR 800, as revised, to locate and identify any cultural resources within the study area before initiating any Federal undertaking.

Action Alternatives

Reclamation would do the following:

- In consultation with the SHPO and area Indian tribes—and based on the Class I survey—develop a research design for conducting Class II or III surveys (1) to determine areas of high or low potential for cultural resources, including traditional cultural properties, (2) to determine sources of impacts and (3) to define additional investigation or protective actions appropriate for each site. The plan would serve to support requests for funding to implement necessary actions.
- Conduct intensive surveys of areas with high potential for cultural resources and/or any areas scheduled for ground-disturbing or potentially ground-disturbing activities to locate cultural resources. During ground-disturbing activities, Reclamation would make every effort to avoid significant cultural resources.
- During construction, if cultural resources are discovered, ensure that work in the immediate areas ceases until a qualified archeologist evaluates the site, takes appropriate measures, and consults with the SHPO.
- Ensure that any project-specific agreements regarding cultural resources are included as specifications in construction contracts and inform construction contractors about the presence of cultural resources within or near the project area and about their protection under Federal and State laws.

- When granting easements on or across Reclamation-owned lands, review the proposal for potential effects on cultural resources and ensure that the entity receiving the easement complies with all applicable cultural resource laws for any activities within the boundaries of the easement.

Specific mitigation cannot be identified until the intensive surveys are completed to determine if cultural resources are present that are eligible for the Register. The following mitigation strategies presume that one or more archeological sites or TCPs will be determined eligible for the Register and will be affected by the proposed action. The exact nature of mitigation would be determined in consultation with the SHPO and others, as appropriate, and documented in a memorandum of agreement with the consulting and interested parties.

- Periodically monitor Register-eligible or unevaluated sites to assess impacts and the need for investigative or protection action.
- Place protective materials over portions of sites affected by erosion or trail construction or use to prevent additional disturbance.
- Recover site data through systematic surface collection or excavation and provide resulting reports to the professional community and interested public.
- Further consult with area tribes about appropriate actions to protect endangered TCP sites and implement those actions where reasonable and feasible.
- Incorporate information about cultural resources into brochures and other educational materials created for use in the study area.

Residual Impacts

Some level of relic collection may continue to occur.

INDIAN SACRED SITES

Affected Environment

Indian sacred sites are defined in Executive Order 13007 as

> "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site."

Federal agencies are required, to the extent practicable, to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sites.

Reclamation has initiated consultation with area Indian tribes to notify them of its proposed action and will continue to seek their assistance in identifying sacred sites within the study area.

Environmental Consequences

Alternative A

Under normal conditions, Indian sacred sites would not be affected under Alternative A. Reclamation would continue to consult with area Indian tribes to locate and identify any sacred sites within the 5-mile zone study area before initiating any Federal undertaking. However, unauthorized OHV use, which could lead to incursions onto the land, would still have the potential to adversely affect Indian sacred sites.

Alternative B

As under Alternative A, Reclamation would continue to consult with area Indian tribes regarding Indian sacred sites within the APE before initiating any ground-disturbing activities. In implementing ground-disturbing activities, Reclamation would avoid areas that potentially contain any cultural resources. However, eliminating recreational OHV use would tend to reduce incursions onto the land, thereby reducing potential adverse effects to Indian sacred sites.

When granting easements on or across Reclamation-owned lands, Reclamation would review the proposal for potential effects on cultural resources and ensure that the entity receiving the easement complies with all applicable cultural resource laws for any activities within the boundaries of the easement.

Alternative C

Recreational OHV use, although it would be limited to designated areas, could lead to incursions onto the land and potential adverse effects to Indian sacred sites. However, these adverse effects could be offset by the OHV use plan.

Alternative D

The effects of Alternative D would be the same as for Alternative B.

Cumulative Impacts

No cumulative impacts have been identified.

Mitigation

Executive Order 13007 does not authorize agencies to mitigate for the impact of their actions on Indian sacred sites. However, it does direct agencies to avoid adverse impacts when possible. If consultations determine that adverse impacts are occurring (Alternative A) or would occur from implementation of any action alternative, then Reclamation would seek means to avoid these adverse impacts.

Residual Impacts

If sacred sites were present and were adversely affected by operations or land use and Reclamation could not find the means to avoid these impacts, then residual impacts would occur.

INDIAN TRUST ASSETS

Affected Environment

Indian trust assets are legal interests in property held in trust by the United States for Indian tribes or individuals. Examples of trust assets are lands, minerals, hunting and fishing rights, and water rights. The United States has an Indian trust responsibility to protect and maintain rights reserved by or granted to Indian tribes or Indian individuals by treaties, statutes, and Executive orders, which are sometimes further interpreted through court decisions and regulations. This trust responsibility requires Reclamation to take all actions reasonably necessary to protect trust assets.

Reclamation contacted the U.S. Bureau of Indian Affairs (BIA) and area tribes about Indian trust assets within the study area. In response, the Hopi Tribe advised Reclamation they have interests in the Little Colorado and the Colorado Rivers. No other potential trust assets in the 5-mile zone study area have been identified.

This draft RMP/EA is being provided to BIA and area tribes for review and comment. If during this review period, Reclamation is notified of any trust assets affected or potentially affected by actions identified in the draft RMP/EA, the information will be included and analyzed in the final RMP/EA.

During implementation of the RMP, Reclamation will be in contact with the BIA and local tribes. Should trust assets be identified, potential impacts will be identified and analyzed, and action taken to avoid adverse impacts. If adverse impacts cannot be avoided, mitigation will be implemented.

Environmental Consequences

No effects on Indian trust assets have been identified under any of the alternatives.

Cumulative Impacts

No cumulative impacts have been identified.

Mitigation

If adverse impacts to trust assets in the 5-mile zone study area are occurring (Alternative A) or would occur from implementation of any action alternative, Reclamation would seek means to avoid these impacts. If adverse impacts cannot be avoided, Reclamation would provide appropriate mitigation or compensation.

Residual Impacts

No residual impacts have been identified.

ENVIRONMENTAL JUSTICE

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," dated February 11, 1994, requires agencies to identify and address disproportionately high and adverse human health or environmental effects of their actions on minorities and low-income populations and communities, as well as the equity of the distribution of the benefits and risks of their decisions. Environmental justice addresses the fair treatment of people of all races and incomes with respect to actions affecting the environment. Fair treatment implies that no group of people should bear a disproportionate share of adverse effects from an environmental action.

To comply with the environmental justice policy established by the Secretary of the Interior, all Department of the Interior agencies are to identify and evaluate any anticipated effects, direct or indirect, from the proposed project, action or decision on minority and low-income populations and communities, including the equity of the distribution of the benefits and risks. Accordingly, this section examines the anticipated distributional equity of alternative-associated impacts with respect to potentially affected minority and economically disadvantaged groups.

Affected Environment

This section provides baseline demographic information used to analyze environmental justice impacts.

Race and Ethnicity

Yuma County and the communities near the 5-mile zone would potentially be most affected by implementation of the alternatives. Population data from the 2000 Census for the State of Arizona, the county, two nearby Indian reservations, and four communities are shown in table V-8. The population is shown for seven racial categories: White, Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Some Other Race, and Two or More Races. The percentages of total racial minority population and the Hispanic or Latino population, a minority ethnic group, are also shown.

Yuma County, the reservations, and communities each have a greater percentage of total racial minority populations than the State of Arizona as a whole. All of the areas (except the Cocopah Reservation) also have a greater percentage of ethnic (Hispanic or Latino) populations than the State.

Low-Income Populations

Low-income populations in the area are identified by several socioeconomic characteristics. As categorized by the 2000 Census, specific characteristics used in this description of the existing environment are income (per capita and median family), the percentage of the population living below poverty level (all persons and families), substandard housing, and unemployment rates.

As shown in table V-9, based on 1999 income as reported in the 2000 Census, the per capita and median family incomes for all areas are less than the State per capita and family income, and all areas have a greater percentage of persons and families living below the poverty level. For both reservations, Gadsden, and San Luis, the percentages of persons and families living below the poverty level are more than double the State rate.

Other measures of low income, such as substandard housing and employment (shown in table V-10), also characterize demographic data in relation to environmental justice. Substandard housing units are those overcrowded and those lacking complete plumbing facilities. The percentage of occupied housing units in the areas with 1.01 or more occupants per room for all but the Cocopah Reservation was greater than for the State. Except for the city of Yuma, the percentage of housing units lacking complete plumbing facilities for all areas was greater than for the State. The 2000 unemployment rates for the local areas ranged from 9.0 to 27.3 percent, compared to the State unemployment rate of 5.6 percent.

Environmental Consequences

This section addresses whether any group of people, including racial, ethnic, or socioeconomic group, would bear a disproportionate share of negative impacts from implementation of the alternatives.

Table V-8—Population, Race, and Ethnicity, 2000

Geographic Area	Total Population	Race								Hispanic or Latino (of any race) (percent)
		One Race						Two or More Races	Total Racial Minority Population[1] (percent)	
		White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race			
Arizona	5,130,632	3,873,611	158,873	255,879	92,236	6,733	596,774	146,526	1,257,021 (24.5)	1,295,617 (25.3)
Yuma County	160,026	109,269	3,550	2,626	1,486	197	37,743	5,155	50,757 (31.7)	80,772 (50.5)
Cocopah Reservation	1,025	474	1	519	0	0	17	14	551 (59.1)	47 (4.6)
Fort Yuma Reservation	2,376	650	42	1,350	1	0	196	137	1,726 (72.6)	662 (27.9)
Gadsden	953	390	0	34	3	2	511	13	563 (59.1)	894 (93.8)
San Luis	15,322	9,007	452	224	25	3	5,265	346	6,315 (41.2)	13,657 (89.1)
Somerton	7,266	3,235	27	47	25	1	3,714	217	4,031 (55.5)	6,915 (95.2)
Yuma	77,515	52,968	2,491	1,168	1,164	145	16,557	3,022	24,547 (31.7)	35,400 (45.7)

[1] Includes Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, Some Other Race, Two or More Races.

Source: US Census, 2000.

Table V-9.—Income and Poverty, 1999

Area	Money Income (Dollars)		Percent Below Poverty Level	
	Per Capita	Median Family	All Persons	Families
Arizona	20,275	46,723	13.9	9.9
Yuma County	14,802	34,659	19.2	15.5
Cocopah Reservation	12,094	25,600	31,4	20.7
Fort Yuma Reservation	8,402	23,750	34,1	30.5
Gadsden	6,562	21,000	45,2	41.7
San Luis	5,377	22,368	35.8	36.3
Somerton	7,960	27,944	26.6	24.0
Yuma	16,730	39,693	14.7	12.1

Source: U.S. Census, 2000.

Table V-10.—Housing, Labor Force, and Employment, 2000

Area	Housing Units				Civilian Labor Force	
	Total Occupied	Percent Substandard[1]	Total	Percent Sustandard[2]	Percent in Labor Force	Unemployment Rate (Percent)
Arizona	1,901,327	8.6	21,088	1.1	61.1	5.6
Yuma County	53,848	14.7	598	1.1	50.3	12.1
Cocopah Reservation	419	7.4	14	3.3	21.0	15.6
Fort Yuma Reservation	793	19.7	36	4.5	45.5	9.0
Gadsden	227	36.1	35	15.4	59.5	19.2
San Luis	3,023	42.3	58	1.9	40.4	27.3
Somerton	1,821	34.5	53	2.9	54.6	9.1
Yuma	26,697	12.1	211	0.8	59.6	9.1

[1] 1.01 or more occupants per room.
[2] Lacking complete plumbing facilities.
[3] Population 16 years and over in the labor force.
Source: U.S. Census, 2000.

The immediate 5-mile zone study area and other communities potentially affected by implementation of the RMP contain high percentages of racial and ethnic minorities and persons and families below the poverty level. Unemployment is significantly higher in these counties than in other areas of the State. Consequently, the potential exists for low-income and minority populations to be disproportionately affected.

Alternative A

Existing environmental justice conditions in the area would continue.

Alternative B

As discussed under "Economics," transferring or exchanging the Hillander "C" tract and removing this tract from agricultural production would adversely affect the agricultural sector of the economy. In 1990 (the latest available Census data) 50.7 percent of the farm workers in Yuma County were racial minorities, while 92.3 percent were ethnic minorities. Thus, any decrease in agricultural production could adversely affect minority farm workers.

Providing water stations would benefit illegal immigrants, who are typically minority and low-income individuals.

Alternative C

The effects would be the same as for Alternative B. In addition, there would be a potential for short-term employment for minority or low-income individuals.

Alternative D

The effects would be the same as for Alternative C.

Cumulative Effects

No cumulative effects have been identified.

Mitigation

No mitigation has been identified.

Residual Impacts

No residual impacts have been identified.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts are those environmental consequences that cannot be avoided, either by changing or mitigating the action.

None of the alternatives are expected to have unavoidable adverse impacts.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitments are decisions affecting renewable resources, such as soils, wetlands, and riparian areas. Such decisions are considered irreversible because their implementation would affect a resource that has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because their implementation would cause the resource to be destroyed or removed.

Irretrievable commitments of natural resources occur when a decision causes a loss of production or use of resources. They represent opportunities foregone for the time that a resource cannot be used.

None of the alternatives would result in irreversible or irretrievable commitments of resources.

RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

For this Federal action, short-term is defined as the 10-year planning life of the RMP, during which time the proposed management actions will be accomplished. Although rehabilitating and revegetating certain OHV areas to their natural state may require more than 10 years, the process will begin during this time.

Long-term is defined as any time period beyond the 10-year planning life of the RMP and the remaining life of the PRPU. As long as the PRPU is used for Reclamation project purposes, other legal purposes, and to accommodate proposed land uses from community development, pressure on natural resources within the study area will continue. This long-term pressure can be attributed to the following: (1) Reclamation's efforts to accommodate public use and (2) the use of the study area for congressionally mandated Reclamation projects.

The proposed management actions are intended to reverse the deterioration of the environment occurring under current conditions. It is assumed that the short-term and long-term goals and objectives for managing the area would not change over time and there will be no loss of productivity of the natural and social environment.